MILL SECTION of
Concrete

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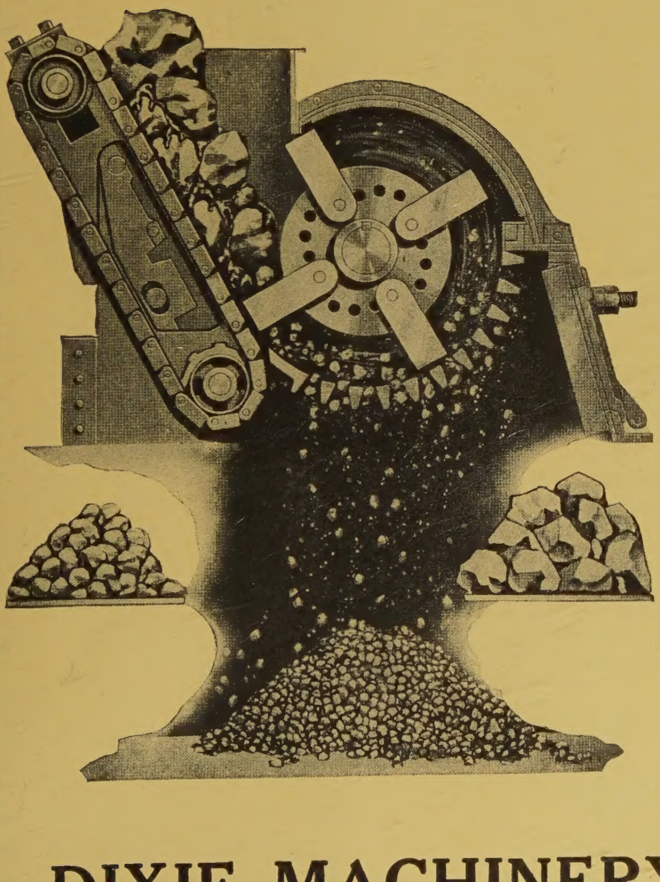

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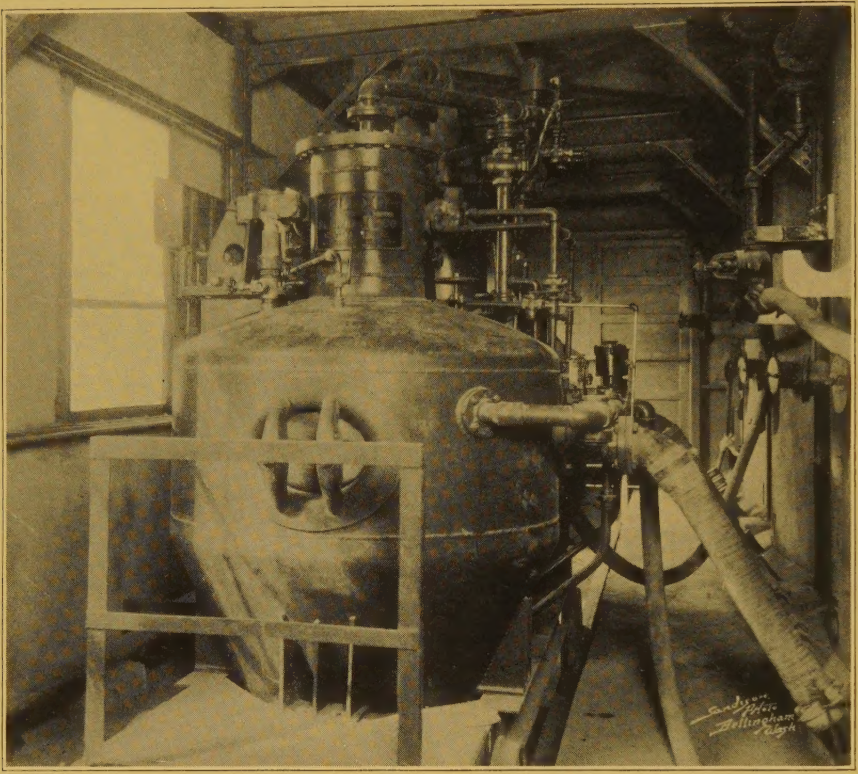
THE FLUXO PUMP

for economical

PNEUMATIC TRANSPORT



The Fluxo has proved a very economical means for the pneumatic transport of dry pulverulent materials, such as cement, raw mix, lime, etc.

The illustration shows a Fluxo pumping cement from storage silos to bins over packing machines, and also from silo to silo. The operation is automatic and very simple.

When employed for removing the contents of silos, the Fluxo is installed outside the silo, drawing the material through a flexible hose from convenient points at the bottom of the silo. Thus no tunnels are required, simplifying the silo construction.

Forty systems have been sold to date.

Information regarding the application of the Fluxo pump to your transport problem will be gladly furnished.

F. L. SMIDTH & COMPANY

ENGINEERS

225 Broadway + + + New York, N. Y.

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MILL SECTION of Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

Volume 36 May, 1930 Number 5

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GRAVITY, flash and fire are of practically no importance to the man who is interested in effective Diesel engine or compressor lubrication. There are other oil specifications that mean little to the lubricating engineer—but there is one test that *is* important. It is the carbon residue test—and you can make it easily.

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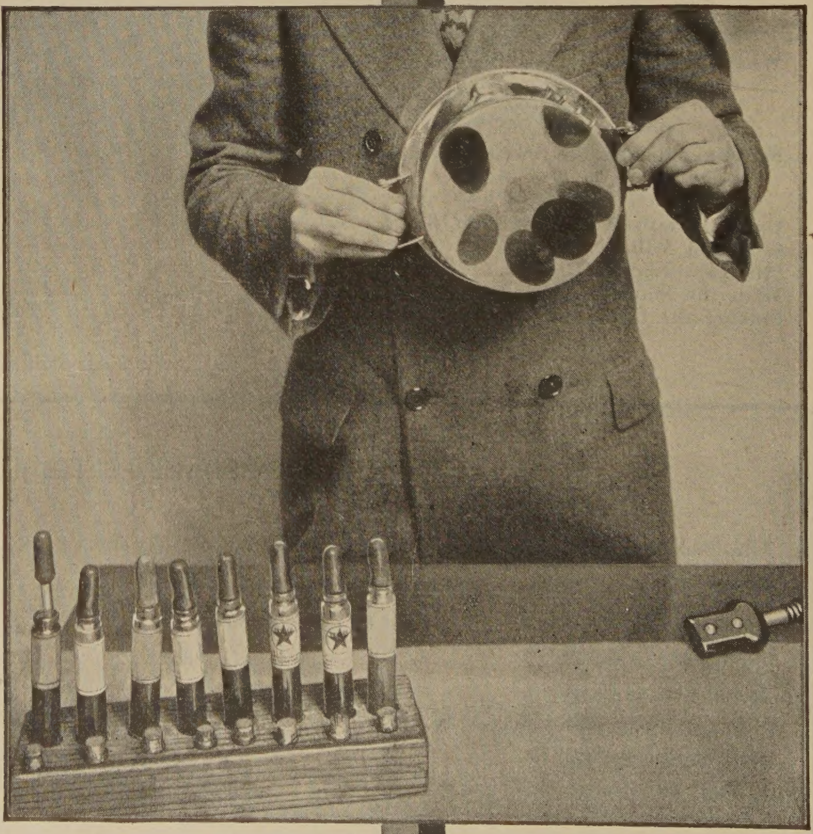
Texaco Oils recommended for Diesel engine or air compressor lubrication are pure distilled oils varying only in viscosity. These oils leave but a very slight trace of color when dropped on a hot plate ***—such as is shown in the center of the plate illustrated below.*** Note the heavy black carbon deposits left around the edges of the hot plate where other less suitable oils were dropped.



THE TEXAS COMPANY
135 East 42nd Street, New York City

TEXACO LUBRICANTS

MILL SECTION of

Concrete

Vol. 36 Chicago, May, 1930 No. 5

Finely Ground Cement Deteriorates Most Rapidly

Cement of Normal Fineness and Extremely Fine Cement Compared Under Bin Storage Conditions—Finer Cement Loses Greater Percentage of Strength and Fineness—No Deterioration in Airtight Bins After Four Months

By N. NICOLAESCO
Chief of Laboratory, Azuga Portland Cement Co., Roumania

The tests reported by this writer come at an opportune time, because of the increasing interest in high early strength cement. One of the ways of obtaining high early strength is to grind the clinker excessively fine. The tests here published indicate that this may be the least desirable method of obtaining early strength.

It is certain that this subject bears further investigation. Recent tests of a similar nature with American cements should be given publicity for the benefit of the cement industry. The pages of "Concrete" are open to such information.

IN pursuing a study of the deterioration of the strength of cement in storage, we determined the fineness of the cement analyzed, proving that much more residue is retained on sieves with 900 and 4,900 meshes per square centimeter after several months of storage than when tested immediately after being ground.

The number of treatises and articles which have appeared up to the present on the subject of loss of strength in cement in warehouse storage, is considerable. In examining this literature one observes that not a single author has determined the fineness of the cement at the time of the test. Only Tomei did so (see Tomei: "The Influence of Air on Cement," Protocolo 11, pages 58-61, 1888). But we have not succeeded in finding any information of consequence except in the single instance where the time of storage was 28 days; and the fineness of cement in those days was much less than at present. In fact the residue retained (in the tests reported by Tomei) on the 900-mesh sieve was 4/10 of one per cent, and 37.6 per cent on the 4,900-mesh sieve.

Rate of Deterioration Increases with Fineness

Through various investigations we have found that there is a direct relation between the fineness of a cement and the rapidity of deterioration of that cement. Previously we had established this fact in a theoretical manner.

Having started on the supposition that after some months of storage in a damp atmosphere the cement would show an increase of retained residue on the sieves when compared with freshly ground cement, we began our study of this question.

TABLE 1

Relation Between Fineness and Percentage of Deterioration in Storage

Cement	Per cent retained on sieve		7-day tensile strength of 1:3 sand mortar[2]		Per cent of increase in amount retained		Per cent of reduction in strength
	900-Mesh[1]	4,900-Mesh[1]	Kg. per sq. cm.	Lb. per sq. in.	900-Mesh[1]	4,900-Mesh[1]	
A_1	0.1	11.0	27.20	386	----	----	----
A_2	0.1	11.0	27.00	383	0	0	Nil
A_3	0.2	19.0	24.60	350	100	81	9.5
B_1	0.0	5.0	28.47	405	----	----	----
B_2	0.0	5.0	28.65	407	0	0	Nil
B_3	0.1	11.0	24.00	341	----	120	15.7

---

[1] Meshes per square centimeter. These are the No. 30 and No. 70 sieves of European laboratory practice, corresponding to about 76 and 178 meshes per linear inch, respectively.

[2] Stored 24 hrs. in air and 6 days in water.

From *Revue des Materiaux de Construction.*

Conclusions Drawn from Tests

The conclusions to which our tests have led us are the following:

1. The quality of the cement when protected from contact with damp air (in a container hermetically sealed with paraffin, or in a bin absolutely inaccessible to damp air) remained unchanged even after a long period of storage.
2. Similarly, the fineness was not affected under this method of storage.
3. Cement exposed to the influence of damp air (in bulk or in sacks), diminished in strength.
4. Along with the reduction in strength, the fineness of the cement was also diminished (i. e., the cement became coarser).
5. The finer the cement, the greater is the effect of the air and the greater is the reduction in quality.

In the tabulation that follows we have indicated the various results of the tests.

A_1 was a portland cement of ordinary fineness, tested when freshly ground.

A_2 was the same as A_1, but tested after 4 months of storage in a hermetically sealed container.

A_3 was the same as A_1, but tested after 4 months of storage in a bin accessible to damp air.

B_1 was a portland cement of extreme fineness, tested when freshly ground.

B_2 was the same as B_1, but tested after 4 months of storage in a hermetically sealed container.

B_3 was the same as B_1, but tested after 4 months of storage in a bin accessible to damp air.

It is thus evident that the reduction in fineness and the reduction in strength are greater with the very finely ground cement than with the cement of ordinary fineness.

The practical conclusion from our investigations is that favorable storage conditions have a preponderant influence in maintaining the quality of cement. In particular, cement of extreme fineness must always be stored in air-tight bins and protected from all traces of moisture.

Agreement Reached on Eckel and Lumnite Patents

By an agreement executed on March 28th, between the Atlas Lumnite Cement Co. and Edwin C. Eckel, Eckel withdraws his opposition to the proposed extension of the Spackman patents, while Lumnite releases all licensees under Eckel patents from liability for possible infringement of the Spackman patents. It will hereafter be possible, therefore, to permit reasonable competition between the two American alumina-cement making processes while preventing unfair competition from foreign sources.

There are at present no licenses under Eckel patents in any state or Canadian province; and existing cement or steel companies will be given preference in issuing such licenses, provided application be made through a responsible executive official.

Overhauled Medusa Plant Resumes Operation

The Medusa Portland Cement Company's Dixon, Illinois, plant resumed operation on March 20th.

Repairs, overhauling, and installation of new equipment including a dust collecting system, was effected during the recent 30-day shutdown. With the resumption of activity, the plant is employing 250 men and producing 6,000 barrels of cement a day.

Northwestern and Lehigh Rate Hearing Set for May

Resumption of the hearing of the application of the Northwestern States and the Lehigh Portland Cement companies, Mason City, Iowa, for readjustment of intrastate freight rates on coal has been set for May 6th.

The hearing had been set originally for March 19th but a postponement was necessary.

The Northwestern petition charged discriminatory rates from eight shipping points and the Lehigh company later intervened on a similar ground.

Lawrence Plant Operating at Capacity

The plant of the Lawrence Portland Cement Company, at Rockland, Me., is now operating at capacity. Present indications are for a busy summer period. Repairs were recently finished on the cement kiln, this being fired after a layoff of about a week. Shipments of cement are going out both by water from Rockland and by rail. It is likely that another overhauling of the kiln equipment will be made in the late fall or early winter.

Lehigh Company and Association Awarded Joseph Holmes Honor For Safety Work

The Lehigh Portland Cement Company, Allentown, Pa., has been awarded a certificate of honor for its excellent work and safety record by the Joseph A. Holmes Safety Association, affiliated with the Bureau of Mines.

The Portland Cement Association was likewise honored for its work in campaigning against lost-time accidents.

Arkansas Plant Capacity to Be Increased to 2,750 Barrels

New equipment being installed at the Okay plant of the Arkansas Portland Cement Company, near Saratoga, Ark., will increase capacity to 2,750 bbls. daily. A new filter is included.

The Okay plant, completed in the summer of 1929, is one of the newer units of the Ideal Cement Company, Denver, Colo.

New Cement Firm to Exploit Plant in Madagascar

A new firm, the Societe des Chaux et Ciments de Madagascar, with an initial capital of $3,900,000, is being formed to operate a cement and lime mill in Madagascar. The new firm is being backed by the Omnium Colonial and will absorb the Compagnie Franco-Malgache d'Entreprises.

Medusa Takes Option on Virginia Ore Lands

The Medusa Portland Cement Company has filed an option at Luray, Virginia, on about 20,000 acres of land belonging to the Alleghany Ore and Iron Company, and is reported to be prospecting for ore.

Ford Cement

The Ford Motor Company, Detroit, in 1929 realized $1,032,000 on portland cement made from slag from its blast furnaces, a report on by-products sales shows.

Black Cements in Europe

Some Sources of Coloring Materials Used to Produce Colored Cements—Methods of Manufacture

By E. T. ELLIS, F. J. I.

In this article a brief account is given of some black cements for which the coloring matter is manufactured from various sources not previously exploited. Sources of these coloring agents are taken up, and the actual modes of preparing the coloring agents are briefly discussed, after which details of suitable proportions for three shades of black cement are given.

It may be well to emphasize an important point, as otherwise some confusion may arise. The coloring of the cement is a subsidiary process, i.e., portland cement is manufactured in the usual way, and then a suitable black pigment is mechanically mixed with it. In no case is the pigment chemically combined with the cement, in spite of the fact that complete separation of the two is often a difficult matter.

A SURPRISINGLY large demand has already been made throughout Europe and in many countries for black cements, in spite of the sombre tints of these. Black cements do not include the brown varieties, although obviously it is somewhat difficult to distinguish in certain instances between a very dark brown cement and a black one. Black cements do, however, include the very dark grey ones, as in this instance the greyish hue is due to a smaller proportion of the pigment being employed than is generally considered necessary, and not the addition of some other definitely grey coloring matter. In view of this, it follows that the actual shade of black can be varied very greatly, but as in the case of red iron oxide colors it will not be convenient to give more than three shades, as experience almost invariably proves that these are sufficient to meet all ordinary requirements.

Carbon Black

An immense number of black pigments have been prepared and described, but examination of most of these shows that they are quite unsuitable for the preparation of black cement. Permanence is a matter of great importance, and unfortunately some of the cheapest black pigments are rather liable to change in contact with the cement itself, or under the influence of moist air. The most suitable of all coloring agents are found in the carbon blacks, of which there are many types, and cement makers must carefully distinguish between true carbon blacks and those which are sometimes erroneously called carbon blacks, and which contain on analysis a negligible, or at any rate, a very small proportion of elemental carbon.

Black substances which are in themselves unsuitable for use in the manufacture of black cement can often be manipulated cheaply and easily, so as to render them ideal for the purpose in view. The main object of manipulation is to reduce the soluble content to a negligible quantity, and to increase the actual content of elemental carbon to the maximum.

Following are some materials from which black coloring agents can readily be obtained, the black in every instance being a carbon black, and, therefore, unacted upon by the cement itself, or by any other influences to which the mixture or the actual concrete may be subjected.

Argol or Crude Tartar.
Calcium and Magnesium Soaps.
Crude Turpentine.
Glue Works Waste.
Petroleum Refinery Residues.
Pitch From Tar Distillation.
Sugar Beet Residues.

It may be mentioned that carbon blacks suitable for the preparation of black cements are sometimes obtained as by-products in organic chemical operations, and if these by-products are calcined in the complete absence of air, either alone or mixed with other chemicals such as alkalies, finely divided carbon black is obtained, from which soluble substances can be removed by the usual lixiviation operations. This black is then fully dried, and subsequently finely ground.

Manufacturing Methods

Each of the above sources of coloring agents requires a certain amount of manipulation, and the main details are briefly summarized.

The purest of all the carbon blacks is obtained by the manipulation of Argol or Crude Tartar. This is used for special brands of black cement, on account of the fact that it will be too expensive for use in the preparation of the ordinary kinds.

The raw material, which is very cheap and easy to pick up in the wine producing districts of Europe and elsewhere, is treated with warm water so that a portion of it may go into solution. That liquor is filtered and evaporated until crystals of a purified acid Tartrate of potash are obtained. These are then decomposed by strongly heating them in the absence of air, until no further gas is given off, and until an intensely black porous mass remains, and after cooling this, again in the absence of air, carbonate of potash is easily extracted therefrom by the addition of dilute hydrochloric or sulphuric acid, or indeed by merely washing the pigment in ordinary water. This carbonate must be completely removed, as the "tartar char" as it is sometimes called is otherwise very deliquescent and entirely unsuitable for the production of black cements. Careful and complete drying is essential, and this carbon black should always be stored in a very dry place if it has to be preserved over a period prior to use.

With regard to the employment of calcium and magnesium soaps as an unexploited source of carbon blacks for use in cement manufacture, readers will no doubt remember that the effluents from these and other similar establishments are often treated nowadays with soluble calcium and magnesium salts, in order to precipitate the soap that they contain in an insoluble state, and to purify the liquors sufficiently to enable them to be discharged into rivers, etc. Laundries and wool washing establishments find great difficulty in disposing of these cakes of calcium and magnesium soaps, although a few of them have been able to use them satisfactorily, but the material when subjected to destructive distillation, again in the absence of air, forms a gas often known as "soap gas." This, instead of being used for illuminating purposes as it generally is, should be burnt in a special way, i. e., so that the flames impinge on water-cooled plates. By this means a very large amount of carbon black of high quality is deposited, which is pretty free from greasy, resinous, and other unwanted substances. According to some accounts it can be packed as soon as it is cool enough without being washed, but in most instances it is a good plan to wash it once or twice, then dry it at a low temperature, and finally grind it very thoroughly before using it for coloring cements.

Probably cement manufacturers may already be familiar with the manufacture of carbon black from crude turpentine. Special burners are employed, in order that as much smoke as possible may be developed, and if the flames do not impinge upon water-cooled plates to which scrapers are attached, the whole of the contents of combustion, including all the smoke, are drawn through chambers, in which the finely divided carbon is completely deposited. That which is found nearest the chimney is the most suitable for the manufacture of black cement, while that which is nearest to the furnace is the least suitable, although unwanted oily and resinous substances can be extracted from it by means of ether and other solvents, if it is considered worth while to go to this trouble and expense. This black, if the best grades are used, does not require to be washed with water. It should, however, be very finely ground, as some of it may be deposited in a comparatively coarse state.

I hardly think that many cement men will be familiar with the employment of glue works' waste for the manufacture of carbon black prior to its employment in colored cement production. This refuse consists mainly of phosphate and carbonate of lime, intermingled in which are numerous organic substances, which can, however, readily be decomposed. It is usual, therefore, to submit the glue works' waste to dry distillation, otherwise calcination, in the complete absence of air, continuing this until volatile products cease to be evolved, and until a blackish more or less porous mass remains. From this, as in the case of butchers' bones, lime salts must be extracted by hydrochloric acid, and the subsequent washing and drying operations are then identical with those indicated under bones.

A great number of residues from petroleum refineries can be used as starting points for carbon blacks required in the preparation of black cements. These residues are mostly solid in character, but it is desirable to mix them with some of the lighter and more volatile oils, until a stiffish paste is produced, and then to heat this up to the point of ignition, and to set it alight. A very smoky flame is produced, and this is led through chambers fitted with textile blankets, in order that all the elemental carbon can be deposited. Here again the best grade for the manufacture of black cements is found nearest the chimney, and the worst grade, i. e., that most foully contaminated with unwanted substances, is that in the chamber nearest the furnace. This last can in some cases be re-burnt, although very often this latter operation results in great wastage of actual black being experienced.

Treatment with ether, alcohol, or other solvents is sometimes necessary in the case of the exploitation of these petroleum refinery residues as sources of carbon black for cement production. Washing with water, in order to remove traces of soluble substances, is again often necessary, and subsequently the carbon black should be carefully dried at a very low temperature in order to avoid possible ignition, and if storage is necessary it must be preserved in a very dry place.

With regard to the exploitation of pitch from tar distillation, this applying both to wood pitch and to that from coal tar, the process is broadly the same as that just outlined in the case of petroleum residues. Pitch, of course, is a solid substance at ordinary temperatures, but it can be ground and mixed with some of the lighter tar oils until a stiff paste is obtained, and this paste heated up to the point of ignition, the flame and smoke being led through chambers as before, to secure complete deposition of the elemental carbon. Cement men who are situated in the vicinity of coal tar distilleries should use pitch very largely. The pulverized pitch, although it has often been proposed as a pigment for coloring cement, is quite useless for this purpose. Extraction with alcohol, ether, or other substances is in certain cases necessary, when carbon black is obtained from pitch, the object of using them being to free it entirely from resinous and oleaginous adulterants, and from undecomposed hydro carbons.

Finally with regard to the employment of sugar beet factory residues for the manufacture of carbon blacks for use as cement coloring agents, the two processes which are employed are broadly the same as two which have already been described, i. e., carbonization is carried out in closed retorts in order to obtain a low grade black, from which soluble constituents must be carefully washed out; or gasification is carried out in highly heated retorts, and the beet gas is then burnt in special jets over which are arranged water-cooled plates, or other devices, so that a much purer carbon black may be deposited. It is difficult to say whether the black obtained by this process from sugar beet residues is better than that obtained by the treatment of the other residues above indicated, my own opinion being that it is equal in quality to any of them, except that obtained by the decomposition of argol. Owing to the development of the sugar beet trade, however, supplies of the residues will become easier and easier to pick up, and cement manufacturers should, therefore, not neglect this important unexploited source of carbon black.

Proper Proportions

Now regarding the proportion of carbon black which can safely be mixed with cements, this, as will be expected and as I have already indicated, is subject to somewhat wide variation, owing to the extreme chemical inertness of element carbon.

Black cements which contain only a small quantity of this pigment are obviously much more economical than those containing large amounts, while if one is using a very deeply colored cement considerably more cement has to be employed in order to secure a satisfactory set. This, of course, is less pronounced in the case of black cements than in the case of red, as the actual quantity of pigment necessary is smaller. It must, however, always be kept in view, especially with the darkest tints of all, that a large quantity of an adulterating substance is present, otherwise the set may be much slower, and the strength of the concrete considerably less than when an uncolored cement was employed. Owing to the cheapness of carbon black prepared from the above unexploited sources, cement firms will not find that they have to sell cements containing it at a close market figure, although as already noted when it is prepared by the argol process, it should only be used for the special brands which are put on to the market at fancy prices.

Suitable proportions for three shades of black cement are given below:

GREYISH BLACK CEMENT

Cement	950 parts
Carbon Black	50 parts

Mix dry, and if the carbon black is not perfectly dry to start with, warm it before use. Incorporate the two very thoroughly.

MEDIUM BLACK CEMENT

This is undoubtedly one of the best formulas for general use, and has been widely employed in Europe and elsewhere:

Cement	900 parts
Carbon Black	100 parts

Mix the two together extremely thoroughly as before, otherwise when the material is employed a streaky effect will be produced. Both the cement and the carbon black must be in a perfectly dry state.

DEEP BLACK CEMENT

The shade of this is very deep and greatly to be desired, but as in the case of other deep shades it is rather an extravagant mixture to use, as about 15 per cent more than uncolored cement has to be used to secure a satisfactory set:

Cement	850 parts
Carbon Black	150 parts

See that the carbon black is in a perfectly dry state, and entirely free from resinous and oleaginous substances before mixing it in.

Merger of French Cement Firms

A powerful cement combination has been formed through the absorption of the Societe Anonyme des Ciments d'Allas et de Marnac, the Societe des Chaux et Ciments de l'Ariege, and the Union Commerciale et Industrielle du Languedoc by the Societe des Chaux et Ciments du Languedoc, Paris, France, which has increased its capital by issuing $1,170,000 in new shares. The Allas and Marnas firm showed net profits of $95,614 last year and Ariege firm netted $30,907 during the same period.

The Societe des Chaux et Ciments de Tronville et Bar-le-Duc has delayed its merger with the Poliet and Chausson firm until June 30, to allow the latter company to complete details for absorbing several other firms at that time.

Czechoslovakian Cement Notes

Due to a fire in its plant last year the cement mills of Podoli, Czechoslovakia, report a 20 per cent drop in sales under the preceding year. Net profits were $21,900 and a dividend of 15 per cent will be distributed.

The duration of the Czechoslovakian cement "cartel," which was due to end this year, has been extended for three more years.

San Juan Plant Shut Down

Due to overproduction, the San Juan, Calif., plant of the Pacific Portland Cement Company closed down on April 1st for an indefinite period.

Rate of Solution of Very Small Particles

It is commonly supposed that rates of solution are strictly proportional to the surface exposed to the action of the solvent. This statement is true for particles whose diameter is larger than about 20 microns (one micron 1/25,000 of one inch). For anhydrite particles smaller than 20 microns, it has been found by the Nonmetallic Mineral Experiment Station of the United States Bureau of Mines, at Rutgers University, New Brunswick, N. J., that the rate of solution is no longer directly proportional to the surface exposed but increases more rapidly than the specific surface.

If the ratio of the rates of solution per unit surface exposed of particles below 20 microns in size to that of particles above 20 microns in size is plotted against the particle size, the curve thus obtained reaches a maximum at 1.5 microns where this ratio was 17, i. e., the rate of solution was 17 times greater than would be predicted from the proportionate increase in surface.

This increased rate of solution may, in the case of the smaller sizes (below 2 microns), be partly due to the somewhat higher solubility of the smaller particle, but in the range from 20 to 2 microns there is very little, if any, variation in the concentration of the saturated solution, and hence the increased rate of solution must be due to some other factor.

Belgian Cement Firms Show Profit

The annual report of Cimenteries et Briqueteries Reunies, Brussels, shows a net profit of $3,318,852 for 1929.

Ciments Portland Artificiels Belges d'Harmignies, Brussels, reports profits of $1,032,102 for 1929—a drop of more than a million francs from the figures of the preceding year.

Ciments de Vise reports net profits of $337,924 for 1929, a drop of nearly two million francs under the preceding year.

French Cement Firms Increase Capital

The Societe des Chaux et Ciments Portland du Haut-Rhin has increased its capital from $3,042,000 to $3,139,500.

The Societe des Ciments de Mantes has increased its capital from $1,950,000 to $2,925,000.

The Societe des Ciments Portland Artificiels de l'Indo-Chine has increased its capital from $2,340,000 to $3,822,000.

Alpha Contracts for Natural Gas

The Alpha Portland Cement Company is one of five firms that has contracted with the Mississippi River Fuel Corporation for an aggregate 30,000,000 cu. ft. of natural gas a day. Delivery began during February.

Penn-Dixie Income

The report of the Pennsylvania-Dixie Cement Corporation, New York City, shows a net income for the twelve months ended March 31st as $329,236, equal to $2.42 a share on $13,588,800 of 7 per cent preferred stock.

Trident to Reopen

The Trident Portland Cement Company plant at Trident, Montana, was to resume operation on May 1st, after a seasonal shutdown.

Fineness Tests in a Tube Mill Without Air Separator

Second Part of the Report of the Committee on Pulverized Coal of the National Coal Commission and of the Committee on Machinery of the Association of German Portland Cement Manufacturers—Increased Moisture Causes Marked Reduction in Grinding Efficiency—Necessity for Air Separators Shown — Greater Fineness Than Necessary Should Be Avoided

By DIPL.-ING. GROSSE, DR.-ING. FORDERREUTHER and DR. ING. RAMMLER

(Concluded from the April issue)

AS the power required is practically independent of the input and is equal to the power consumed by the empty run N_L, the work required is as follows:

$$A_{ges} = \varphi\,(D) = \frac{N_L}{D} = \frac{91.8}{D}\ (kWh/t)$$

or:

$$A_{ges} \times D = \text{constant}$$

The work required thus varies with the input according to a hyperbola with equal legs (Fig. 5 in April issue). It increases with decreasing input first very slowly, then more and more rapidly.

The curve in Fig. 5 applies to practically all varieties of coal in a given mill, for the value N_{ges} in the equation $A_{ges} = N_{ges} : D$ varies from the empty run only slightly, and, according to the above, different varieties of coal produce either no deviations or very slight positive or negative deviations. If the mill feeding device insures equal input at all times, the varying resistance to grinding does not become manifest in variations of work done, or does so only slightly, being revealed entirely by the varying fineness.

Moisture Reduces Grinding Efficiency

This was observed clearly in Test 1. The moisture of the coal varied here considerably at the start. Moisture has an effect on the resistance to grinding. The input was kept constant, the power consumption remained unchanged at the empty run value, yet the variations in resistance to grinding were definitely reflected in corresponding variations of the fineness, namely, the fineness for 3.6 per cent moisture was 48.5 per cent retained on the No. 70 sieve, while for 0.5 per cent moisture only 18.5 per cent was retained on the same sieve. The effect of moisture is thus very pronounced in a tube mill. A change in moisture from 0.5 to 3.6 per cent has the same effect on the fineness as is produced by changing the input from 3 to 5.2 *t/h*, or expressed in yet another way, for a fineness of 48 per cent (on No. 70 sieve) a decrease in moisture from 3.6 to 0.5 per cent brings about an increase in input 1.8 times the former. Without doubt this drop in efficiency with increasing moisture content becomes even more apparent for greater finenesses.

Since fineness is the only quantity in a tube mill which reveals differences in resistance to grinding, it is clear how very important it is for fineness tests in tube mills to use a very accurate method for obtaining samples of pulverized coal for the sieve analyses. The above mentioned values demonstrating the effect of moisture content show also that keeping this quantity as nearly constant as possible is a prerequisite for obtaining comparable data, as otherwise the test results become scattered, following no consistent rule. It is, therefore, necessary in making fineness tests to watch the drying process most carefully and to provide quick checks of the moisture content of the coal at not too long intervals.[1] The latter is important not only for the control of the dryer, but is absolutely necessary for the evaluation of the test results.

Input and Work Required in Their Relation to Fineness

Fig. 6 shows input and work required in their relation to fineness, expressed by the residue on the No. 70 sieve. The input first decreases uniformly and slowly with increasing fineness (decreasing residues); it then drops very suddenly in the vicinity of 15 to 5 per cent retained on the No. 70 sieve—that is, within the range of greater practical importance for the coal in question. Correspondingly the work required first increases gradually and rather

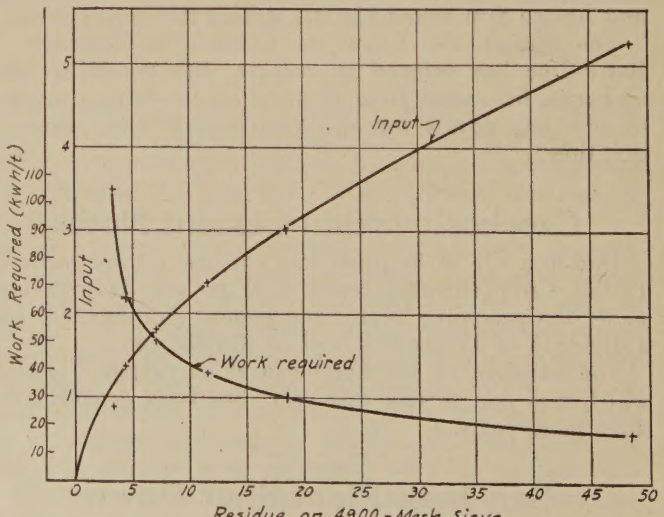


Fig. 6—Input and work required as functions of the residue on the No. 70 sieve.

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[1] See also Rosin and Rammler, "Instructions for Mill Tests," 16th Report of the Pulverized Coal Committee of the National Coal Commission, p. 13 and 23.

Translated from *Zement*, issue of March 10, 1930.

uniformly, then takes a sudden leap within the range of 15 to 5 per cent, retained on the No. 70 sieve. Equal changes in fineness thus result in the greater a change in input and work done, the higher the fineness range dealt with. Rammler succeeded in establishing the analytical equations controlling these relations.

Producing the curve of input-fineness, as shown in Fig. 6, to the abscissa, it becomes reasonable to assume that its shape is that of a parabola with the equation $y = c \, . \, x^n$, where n is positive. In figuring the values of c and n from a series of points along the curve, approximately the same results are obtained throughout, so that the curve of input-fineness may be approximated by the equation:

$$D = 0.59 \, . \, R^{0.56}$$

where R represents the per cent retained on the No. 70 sieve, while D is the input in t/h. This equation has the general form of a parabola which is symmetrical with respect to the abscissa (fineness axis) and whose origin corresponds to that of the coordinates. The following important theoretical knowledge is thus derived: In a tube mill without screens or air separator the input varies with respect to fineness (expressed as residue on the No. 70 sieve) following a general parabolic function, whose equation is $D = c \, . \, R^n$ (where $n > O$).

The constants c and n represent on one hand the resistance to grinding offered by the coal, on the other hand peculiarities of mill design; aside from these, the constants c and n depend also on the sieve used. Further tests will show whether variations in resistance to grinding of different varieties of coal affect both or one of the two constants. Thus two accurately made tests suffice to establish the curve of input-fineness, which will be carried out for different varieties of coal at a later date.

Since the work required is expressed by the equation:

$$A = \rho\,(D) = \frac{N_L}{D}$$

it may also be expressed as a function of fineness by putting $D = c \, . \, R^n$ in accordance with the above quoted relations. We then obtain:

$$A = \frac{N_L}{c \, . \, R^n} = \frac{N_L}{c} \, . \, R^{-n} = c_1 \, . \, R^{-n},$$

where

$$c_1 = \frac{N_L}{c}$$

This is the equation of a general hyperbola. The following is true: The work required varies with respect to fineness (expressed as residue on the No. 70 sieve) in accordance with a general hyperbolic relation with equation: $D = c_1 \, . \, R^{-n}$.

In the present example:

$$A = \frac{91.8}{0.59} \, . \, R^{-0.56} = 155.6 \, . \, R^{-0.56}$$

Two tests, therefore, suffice to establish the input-fineness as well as the work required-fineness curves. Placing input and work required by the usual fineness of 15 per cent equal to 100 per cent, we obtain Table 7.

TABLE 7

Fineness Per Cent (No. 70)	Input Per Cent	Work Required Per Cent
5	55.5	182
10	81.5	127
15	100.0	100
20	119.0	88
25	133.0	79
30	147.0	70
35	161.0	63

Need for Air Separators Shown

In increasing the fineness from 15 to 5 per cent, the input drops by 55 of its value at 15, while the work required increases simultaneously 1.8 times. The quantity of fine dust, predominating more and more with increasing distance from the charge end of the mill, coats the decreasing number of coarse particles. The latter are thus no longer effectively exposed to the action of the mill, so that a considerable distance in the mill is required to pulverize the last coarse particles. This is demonstrated clearly in the tube mill diagram, Fig. 7, which was produced as follows: Upon completion of test 1, the different manholes of the mill were opened immediately and samples were taken at intervals of 0.5m. These were separated on the No. 70 and No. 30 sieves; the residues were platted against the distance from mill end. It is seen that one-third of the total mill length is required to reduce the residue on the No. 30 sieve from 38 to 8 per cent. To reduce this residue further from 8 to 2 per cent, another one-third length is required. This illustrates the coating action of the fines in a tube mill. Such facts as these point convincingly to the advantages of air separation in increasing the efficiency of a tube mill. The success of mills provided with air separators needs no further explanation.

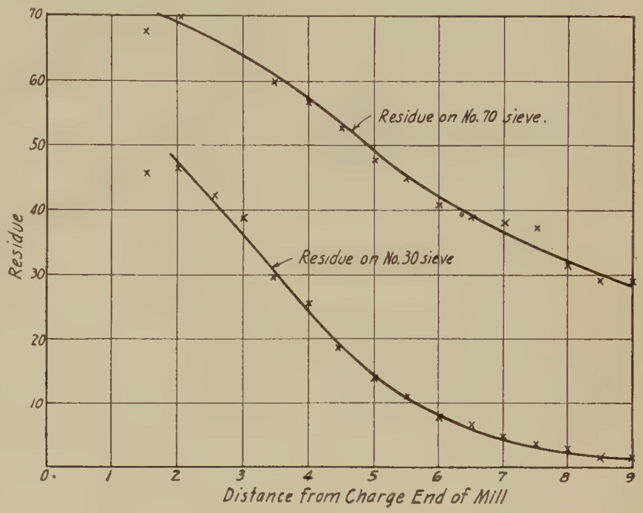

Fig. 7—Tube mill diagram.

Greater Fineness Than Necessary Should Be Avoided

Considering the sharp decrease in input and sharp increase of work required within the range of the great finenesses customary today, one becomes aware of how important it is for the economy of pulverizing to pulverize only as fine as absolutely necessary for each variety of coal and method of use. For, according to the results of the tests here described, such items as work, energy consumed, cost of labor, oiling and repairs, per ton of pulverized coal, increase with increasing fineness not in a simple proportional relation, but practically as a hyperbolic function. It is not known to the authors whether extensive tests have already been undertaken to determine the most economic fineness for rotary kiln use in individual cases; on one hand, with respect to quality of clinker and pulverized coal consumption per ton of clinker; on the other hand, with respect to the cost of production of pulverized coal. Such investigations are of utmost importance for the economy of cement manufacture.

In considering Fig. 6 attention is drawn to the high absolute values of work required. At 15 per cent residue on the No. 70 sieve the work required is already 34 kWh/t.

These high values are partly due to the high resistance offered to grinding by the hard lean coal. It may also be questioned whether the mill had the optimum charge. The beneficial effects that result from the correctly selected charges of the different compartments according to weight, size and properties of the charge units are well known.[2]

Dust Collecting. Table 4 shows that the fineness of the suction filter dust is exceedingly high, varying between 0.8 and 2.6 per cent residue on the No. 70 sieve, as a general rule showing that the higher the input the lower the fineness. The quantity of the dust collected varies between 1.3 and 8.3 per cent of the input, the quantity being greater with smaller input.

Work Required by Accessories. The power furnished by the motors for conveying of the coal before pulverizing, conveying it after pulverizing, and for dust collecting, remained approximately constant and equal to the empty run value, independent of the input. The items were as follows:

Power consumed by dust collecting devices	7.5kW
Power consumed by conveying of coal	7.5kW
Power consumed by conveying of coal dust	6.5kW
	21.5kW

The work required per ton of coal is obtained from these figures by dividing by the input. The work required by the accessories per ton of substance pulverized increases as the work required by the mill as a hyperbolic function of a decreasing input.

Further tests with different varieties of coal shall serve to supplement and amplify the results obtained and will give some clue as to the relative resistance to grinding of the different coal varieties.

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[2] The observed absolute values of work required should not be interpreted in a general way. In the present case the work required was of no particular importance since the total energy consumption of the installation was covered by waste heat. Finally, under normal conditions the lean coal is pulverized only as an admixture with pulverized coal, the latter being separated beforehand, so that the average work required per ton of pulverized coal lies much lower than that of the lean coal alone.

Southern Chile Consumes Almost Entire Native Cement Output

THE average annual consumption of cement in Chile is approximately 1,150,000 barrels. Official figures are not available, but the figure cited may be considered sufficiently accurate for general purposes.

The Sociedad Fabrica de Cemento de el Melon, located at Calera, Chile, is the only important cement factory in the country. It was organized in 1906, and is today operating with a paid up capital and reserve of about $3.-500,000, United States currency. The business has been extremely profitable as will be seen from the fact that during the last five years annual dividends of 12½ per cent have been paid on the par value of the shares, in addition to costly plant improvements and extensions. This company is reported to have produced 720,000 barrels of cement during 1927. The demand for its product in South Chile was such that the northern sections were dependent entirely on foreign importations.

At the present time the factory of the Sociedad Fabrica de Cemento de el Melon has a yearly capacity of 1,000,000 barrels. The recently completed extensive plant improvements increased its yearly capacity to the present figure, from 600,000 barrels per year! A new cement factory, to be located between Valparaiso and Santiago, has been organized by a group of capitalists in Santiago but it has not yet commenced operations, and nothing is known of the capacity it will have. It is understood, however, that it will be a large concern.

Notwithstanding the very considerable domestic production of cement, there is still a very good market in Chile for imported cement. During 1927, the last year for which Chilean customs statistics are available, Chile imported 705,008 barrels of cement, valued at $1,365,357. This was approximately one-half of Chile's estimated consumption for that year.

Germany and Belgium are the principal contributors to Chile's imported cement requirements, while the United States occupies third place. The following table shows Chile's cement imports for 1927 by nations of origin.

	Quantity	Value
Germany	360,100	$637,837
Belgium	136,384	265,174
United States	57,481	147,828
Jugo-Slavia	41,679	98,072
Norway	35,155	52,173
Denmark	32,845	65,006
Great Britain	28,207	63,459
France	5,652	8,530
Holland	4,972	23,854
Sweden	2,099	2,928
Spain	434	766
Total	705,008	$1,365,357

(The peso equals 12 1/6 cents in U. S. currency.)

Although the domestic production of cement is increasing each year, the demand for imported cement also continues to increase. This is because the requirements of the nation are developing faster than the local industry, and in view of proposed building and construction program mapped out for Chile for the next few years, it is likely that cement imports will continue to increase. The following figures show Chile's cement imports by years since 1913:

	Barrels
1913	843,123
1923	321,990
1924	440,042
1925	394,768
1926	556,598
1927	705,008

The foreign cement imported during 1927 through the ports of Antofogasta, Tocopilla and Chanaral, was valued at approximately $553,571 U. S. currency.

Canada Cement Company to Build Plant in New Brunswick

The Canada Cement Company will build a plant at St. John, N. B., this year. The site of the plant is on both the Canadian Pacific Railway main line and the eastern harborfront.

The intention is to begin work on the new plant before the first of June, and to have it ready by early fall, at the latest. Facilities will include a loading pocket, to be operated by steam, whereby the cement will be loaded in barrels and bulk on steamers at the adjoining wharf, as well as on cars at the new railroad siding. All the land necessary has been acquired.

French Cement Firm Building New Mill

The Societe des Ciments de Verdun has arranged with the banking firm of Benard Freres for the capital necessary to complete its new mill. at Brieulles-sur-Meuse, France, which will be ready for operation within a few months.

~ EDITORIAL ~

Where Future Profits Must Originate

WE hear the prediction that cement mill equipment must be almost entirely replaced with improved installations before profitable operation can again become the rule.

With the older mills this may be a close approach to the truth, for it has been estimated that about 25 per cent of the mills now operating were in need of new installations even before recent developments came into the picture.

It is certain that important changes will be required for the manufacture of high early strength cement in plants not already producing such cement. Changes from open circuit to closed circuit grinding of raw materials and clinker will involve further new installations of major importance in many mills. The same is true of improved equipment for recovering waste heat, for reducing the water content of slurry and for simplifying the handling of materials.

There is little doubt that the future profits of the cement industry must come through lower production costs rather than through the more hazardous procedure of price increases—hazardous because of the present public temper toward the industry.

The mills that are first to be modernized in line with the requirements of the new order of things will be the first to operate on a profitable basis.

Basing Production on Demand

PRODUCTION of cement for the twelve months ending with March averaged about 66 per cent of capacity. For March the figure was 51.5 per cent, or 4.1 per cent higher than March, 1920.

This excess of capacity over production stands out as one of the most menacing clouds in a slowly clearing sky. So long as excess capacity means that abnormally heavy stocks are being carried, just so long will the menace continue.

Is it necessary to have abnormally large stocks, even where there is excess capacity? Not if production is kept in harmony with future demand. Gauging of future demand may therefore become the means of wiping out the menace of excess capacity.

Gauging of future demand is, in fact, one of the duties assumed by the Cement Institute, a statistical organization formed late in 1929. With this service available to sales managers, individual cement manufacturers over the entire country may be able to hold production more in line with demand, much as the producers in California have done.

This phase of the Institute's activities will be difficult because of the large area covered and the great number of units involved. It amounts, in effect, to regulation of production. In other industries such efforts have had varying degrees of success. The oil industry has succeeded while the copper industry has failed. The lumber industry is about to try it.

If the cement industry meets with even partial success the conditions arising from excess capacity may be greatly improved.

Whose Grievance Is This?

A MATERIAL dealer complains that a cement salesman signed up a concrete products manufacturer of doubtful credit standing for the year's requirements, at a preferred price, then brought the contract to the dealer with the request that the order be handled through him.

The dealer's complaint is that, without being consulted, he was jockeyed into a position where he had to choose between assuming a doubtful risk or losing the business. He assumed the risk, shouldering the responsibility of collecting the account in full.

But what can the cement manufacturer do about it? The dealer complains about having to assume responsibility for this account, but he would object far more vigorously if the cement company were to assume it—that is, if the cement company were to ship to, and bill, the products manufacturer direct. The dealer would claim his differential, even though he neither handled the cement nor assumed any financial responsibility.

If the dealer expects a profit out of this sale, why should he not assume the responsibility of delivering the cement and collecting the account? His complaint appears to be based on the desire to get something for nothing. Whose grievance is this?

Industrial By-Products as Raw Materials

EXCEPT for the utilization of blast-furnace slag, and bauxite waste to a lesser degree, the cement industry has largely neglected the possibilities of reducing production costs through the use of industrial by-products as raw material.

The steel and aluminum industries are not the only source of by-products suitable as raw material for the manufacture of cement. Several other metal extracting operations produce equally suitable materials. Calcium carbonate in a form available for use as raw material in cement production is produced in large and regular quantities as a by-product in the manufacture of borax.

Here is a worth-while field for the industrial chemist to investigate.

Plant Introduces New Ideas Into British Cement Industry

Largest English Jaw Crusher Installed in G. & T. Earle Plant at Wilmington, Hull, Takes Five-Ton Rock—Features of High Speed Secondary Crusher—Raw Mill Drives—Description of the Kilns and Coolers—The Coal Grinding Plant—Special Cement Storage Hopper—Plant Capacity Is 3,200 Tons Per Week

MANUFACTURE of portland cement was recently commenced at the new factory of Messrs. G. & T. Earle, Ltd., cement manufacturers, of Hull, England. The site selected is at Hope, on the southeastern border of the High Peak district of Derbyshire, about midway between Manchester and Sheffield. A brief summary of the directions in which accepted practice has been departed from, and new ideas now being tried out, will be of interest.

For the first time a gyratory crusher for fine crushing in cement works is being used. Exit gases are led directly into dust collecting fans. Only three elevators have been fitted throughout the works; one of them lifts coal from the railway wagons into the storage hoppers, the second is for fine coal storage, and the third restores dust from the kiln induced-draft fans back into the kilns. The processes of crushing, grinding, kiln slurry feeding, and the preparation of the clay are all accomplished without the aid of a bucket elevator. There is no tramway in connection with clay-winning and washing. The clay is dragged by scraper gear direct from the clay-field into a clay washmill and thence pumped into storage.

The factory is laid out for a cement production of 3,200 tons per week and arranged with a view to future extensions. On visiting the site attention is arrested by the hilly nature of the ground, and one appreciates that the layout of the quarries and plant has been to a large extent determined by the contours of the ground. The quarry floor is 875 ft. above datum, the works themselves finish with the clay washmill at 570 ft.; thus there is a difference of 305 ft. from highest to lowest levels.

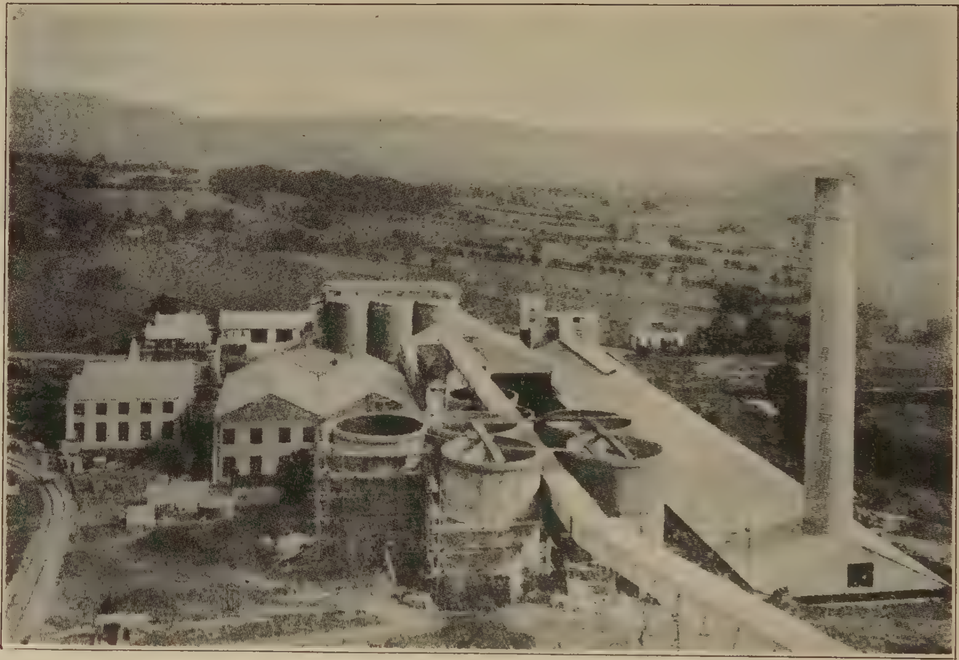

Figure 1. General view of the G. & T. Earle, Ltd. cement plant, located at Wilmington, Hull, England

The Quarry

The limestone is of high quality, practically free from moisture, and contains 97 per cent of calcium carbonate. A quarry face about 700 ft. in length was opened during the construction of the factory in preparation for large-scale blasting. Shortly before manufacture commenced, the drilling of this face was completed, and at one operation about 30,000 tons of limestone were dislodged and broken to a suitable size for picking up by the electric navvy. The holes, drilled by well drills of the company's own manufacture, were 6 in. in diameter by 35 ft. deep and were exploded simultaneously.

The broken limestone is picked up by an electric navvy

Abstracted from *Cement and Cement Manufacture*, issue of January, 1930.

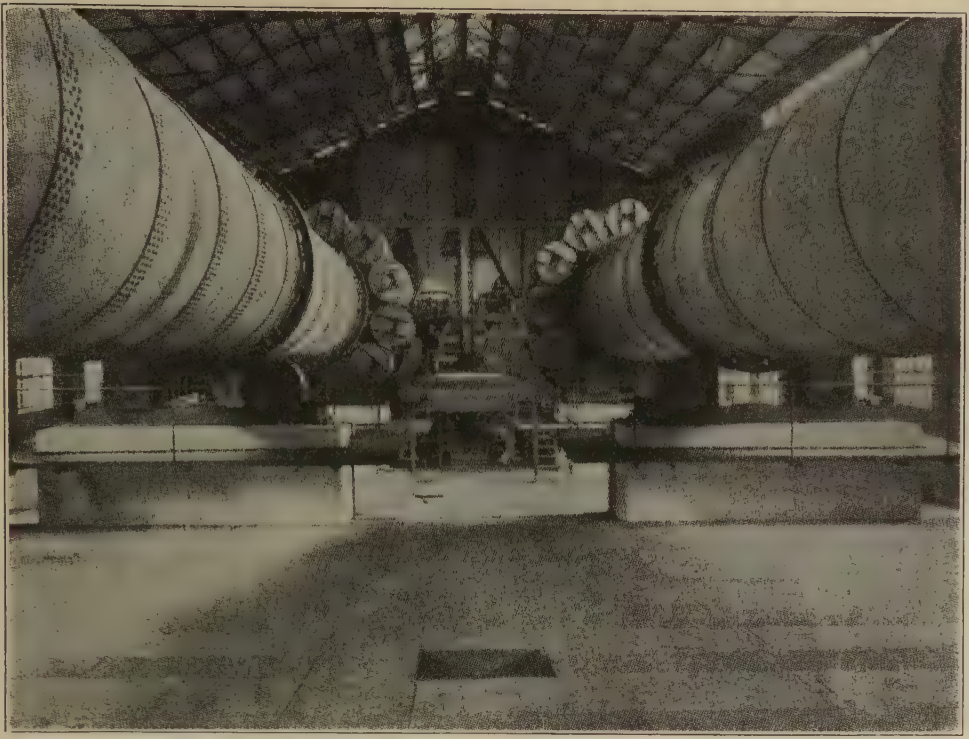

Figure 3. Rotary kilns, looking toward the cooler

with a bucket of 3½ cu. yd. capacity and caterpillar wheels for traveling. The slewing of the jib is accomplished by a self-contained unit operated by its own motor; in fact, a separate motor is provided for each motion. A 110 h.p. motor takes care of the hoisting, while slewing and racking each has its own 40 h.p. power units.

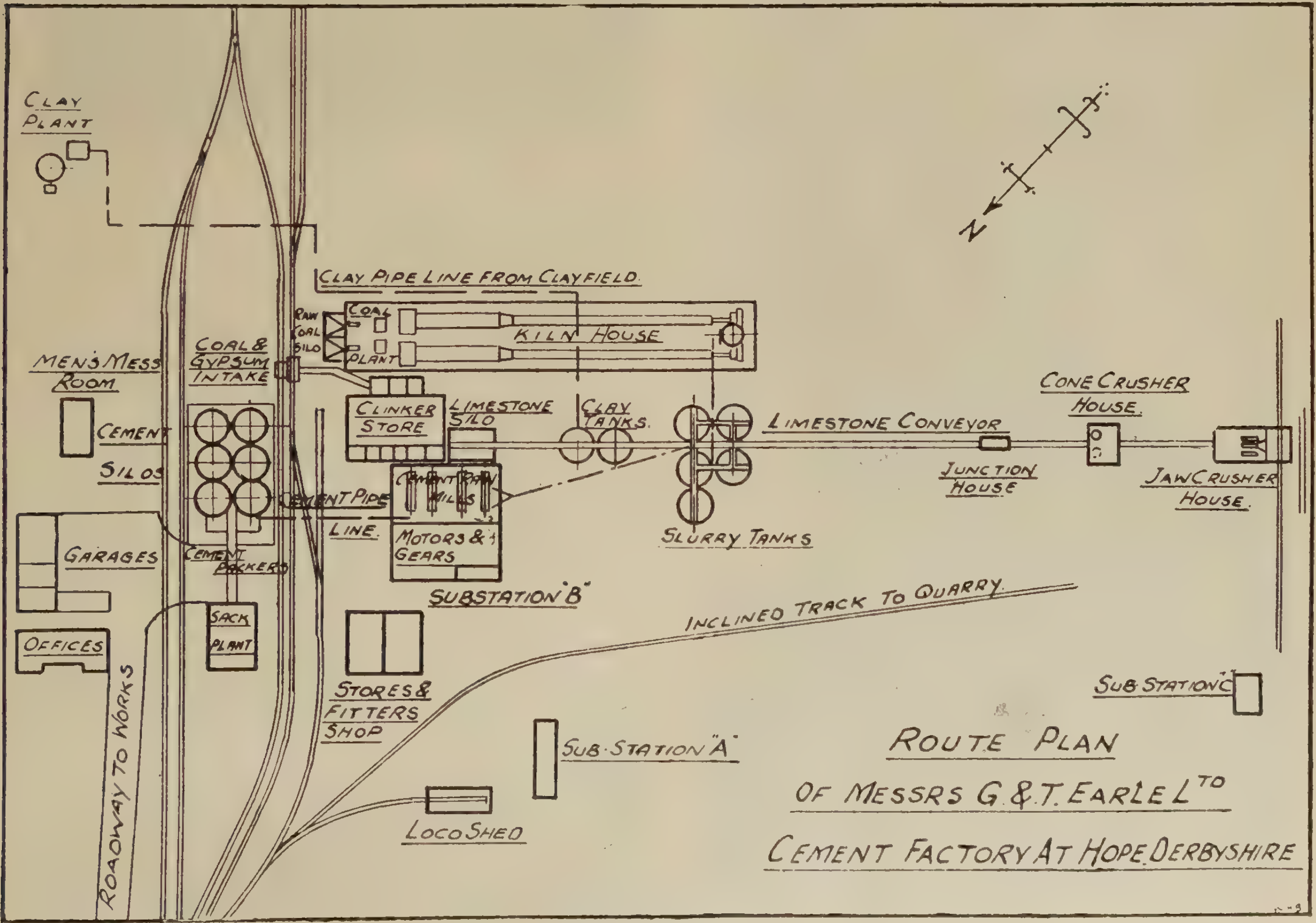

Figure 2. Layout of plant in hilly topography

Each of the three motions is controlled by a separate reversing-contactor type stator panel with mechanical and electrical interlocks and overload relays. Master controllers fitted with vertical hand-levers actuate these contactors, while two-pole overload protection is provided throughout. Clutches are operated pneumatically with a minimum of effort from the chargeman. The controls provided fully protect the motors, which can be stalled for a considerable interval without damage.

The two electric locomotives used to convey the limestone from the quarry face to the crusher house are each driven by two 27 h.p. motors and are capable of taking a 50-ton load up the steepest quarry gradient, which is 1 in 50, at a speed of 10 miles per hour. Direct current is collected by two collector shoes in contact with a third rail in the center of the track. The 400-volt 3-phase current is converted to a 250-volt D. C. supply with earthed return to provide the necessary power for these locomotives. Steel cars of standard and 7 cu. yd. capacity are used for conveying limestone to the crusher house.

Gyratory Crusher for Limestone

In the crusher house building is installed the largest jaw crusher yet built in England, having a 6 by 4 ft. opening and weighing about 133 tons. It is capable of taking stone weighing five tons and crushing it down to a 6 in. size, the output being about 250 tons per hour. This crusher is driven by a 250 h.p. motor, and the crushed stone proceeds to a secondary crusher of the gyratory cone type. The latter crusher differs from the usual run of gyratory crushers in that it has a very much higher speed (about 450 r.p.m.) and the cone is flattened towards the base. In the standard gyratory crusher the largest size stone which can fall through is determined by the distance between the cone and casing at its widest. In this fine crusher, however, the flattened cone and the high speed delay the exit of the crushed material for at least one complete revolution of the mill. It therefore follows that the largest size stone is regulated by the distance between the closed side of the cone and the casing, and not by the open side. The shock of the crushing is taken by about forty spiral springs, the tightness of which, and the size of the crushed product, can be regulated while the machine is running. The weight of this crusher is about 50 tons and its output 225 tons per hour when crushing down to ½ in. size from 12 in. blocks. It is the largest crusher of its type in England.

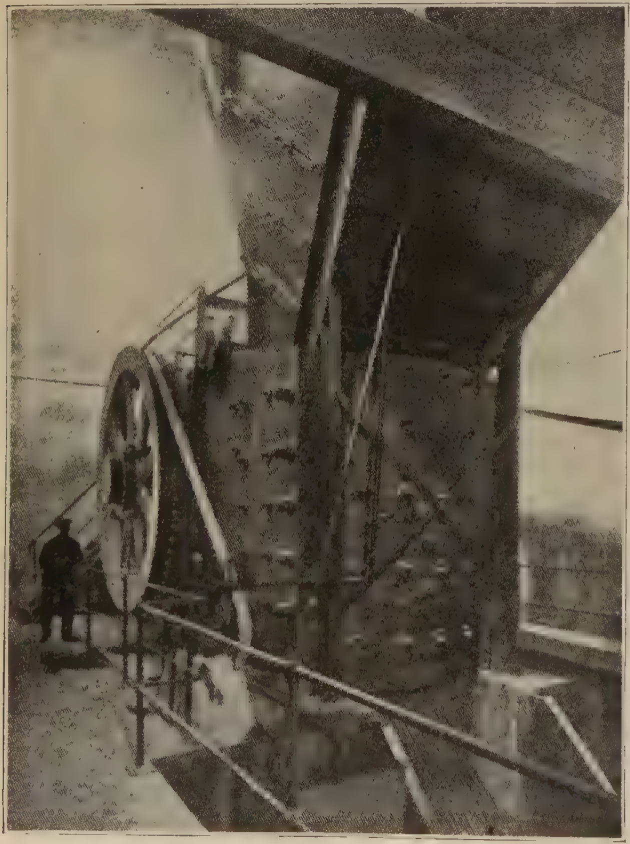

Figure 4. Seventy-two by 48 in. jaw crusher

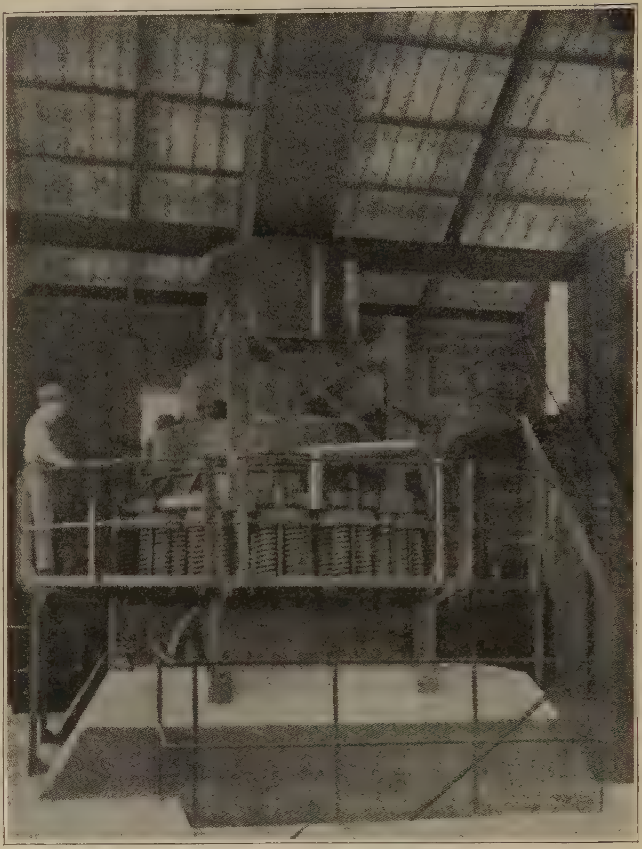

Figure 5. The cone crusher

There is a drop of 198 ft. down the hillside between the jaw crusher entrance and the top of the limestone silos, and this has to be provided for. From the quarry floor to the jaw crusher the stone falls 28 ft. and from thence to the secondary cone crusher intake a belt conveyor 353 ft. long by 42 in. wide lowers the stone a distance of 59 ft. to the cone crusher. The final descent down the hillside is by a chute in which heavy chains are arranged to check the flow of the stone before reaching a belt conveyor which conveys it to the limestone silo, built in reinforced concrete.

Drive for Raw Mills

The raw mills, as well as the dry mills mentioned later, are driven direct from the reduction gearing through a coupling and shaft fixed to the mill in line with the axis, thus dispensing with the pinion and spur-ring wheel usually provided for tube mills.

The slurry from the raw mills is run through a motor-driven mechanically-vibrated screen which takes out any coarse matter before the slurry passes to the centrifugal pumps which convey it to the storage tanks.

The slurry storage is accommodated in five reinforced concrete tanks each of about 17,000 cu. ft. capacity, which have no mechanical stirring gear but are provided with compressed-air mixing arrangements through fixed pipes at the bottom of each tank.

Clay Plant

In the clayfield a washmill of 20 ft. diameter, provided with a 104 h.p. motor, washes the clay at the rate of 60 tons per hour, from which point it is pumped to the works by plunger pumps into two clay tanks each holding about 620 tons of clay.

The method of winning the clay is by means of a scraper digger having a 3-yd. bucket and capable of an output of 60 tons per hour with a maximum length of haul on the ropeway of 830 ft. A 150 h.p. motor provides power for this scraper, which, working one shift per day, provides clay sufficient for the output of the factory.

From the clay washmill the "slip" is pumped to the works 780 yds. distant, where it is stored in two clay tanks each holding 620 tons of clay "slip." From these tanks the "slip" gravitates through a float-valve into a measuring tank from whence two bucket wheels with variable speed control supply measured quantities to the mills, also by gravity. The means by which the "slip" in the measuring tank is kept at constant level by means of a float valve is of interest. The float, instead of acting directly upon the valve, is fitted with contactor gear and a small motor which turns the valve wheel backward and forward according to the varying pressures from the clay tank and the filling requirements of the mills.

Kiln House

Two kilns are housed in the kiln building which also accommodates the coal grinding mills, each having a rated capacity of about 10 tons of clinker per hour. The coolers are of the latest design, comprising twelve integral coolers arranged around the periphery of the kiln itself. These coolers are fitted with a large number of hanging chains which, as the kiln rotates, alternately become buried in the clinker and acquire part of the clinker heat in order to give it out again to the ingoing cold air when the movement of the kiln raises them from the hot clinker.

From the kilns the clinker drops on to a belt conveyor made of special fabric and designed to withstand hot temperatures. This conveyor carries the clinker into a small pit which is emptied at frequent intervals by means of an overhead crane and grab which dumps the clinker into a store having a capacity of 3,350 tons at floor level.

Coal Grinding Plant

In the kiln house building behind the burner's platform is situated the coal-grinding plant. This consists of combination ball and tube mills through which hot air from the clinker coolers passes, thus combining the operation of drying and grinding and dispensing with the necessity for a coal drier. The coal is recovered from the hot air by means of a cyclone and elevated to fine coal storage bins, thus enabling the coal mills to be shut down at intervals for repairs and also enabling them to be run at full output when the kiln consumption is less than the mill capacity.

Coal is received at the works sidings in railway cars which are run on to a tippler from whence the coal is elevated to reinforced concrete coal silos at the rate of 120 tons per hour. The same tippler is also used for discharging gypsum in bulk, a by-pass conveyor being provided for this purpose.

Grinding

The grinding department of this works is a spacious building combining both the raw and clinker grinding mills. The building is divided by a partition, on one side of which are the high and low tension switchboards together with the reduction gears and motors, which are fitted to all the mills. A slow-speed shaft for each mill projects through the wall into the grinding room proper, in which are also placed the pumps for transporting both the slurry and the finished cement.

Cement Mills

These mills, two in number, are similar to the raw mills of 36 ft. length and 72 ft. 2½ in. diameter, but are fitted with 750 h.p. auto-synchronous motors working at 3,000 volts. From the cement mills the cement is transported to storage by a pneumatic system through a pipeline 336 ft. long and 4 in. in diameter. The vertical height to which the cement is elevated through this pipe to the silo is 73 ft. 9 in., and four rotary compressors, each having a cubic capacity of 525 ft. at 40 lbs. pressure, provide the necessary power for the system.

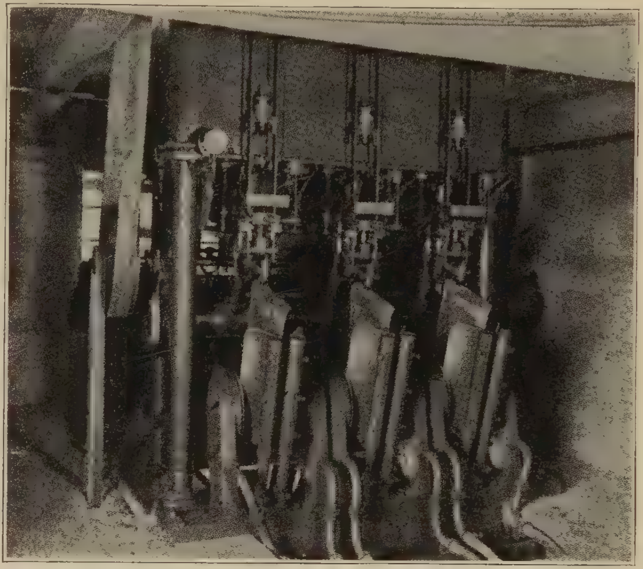

Figure 6. One of the packing machines

The cement from the mills runs into one or other of two tanks fitted with a float valve which is operated by the level of the cement in the tank. The release of this valve admits air into the tank, which causes the cement to be projected into storage; meanwhile the other tank is being filled in similar manner.

Cement Storage

Six reinforced concrete silos, each of 1,500 tons capacity, are provided, one being divided into compartments for special grades of cement in small lots. Packing is done automatically, involving the use of valved bags. These bags are hung on the delivery spout of the weighing machine, and when the correct weight of cement flows into them they are automatically discharged from the machine and fall down a chute ready for loading into railway or road vehicles. Above the weighing machine is a special cement storage hopper fitted with mixer arms after the manner of a slurry mixer. A slight and continuous injection of compressed air to the hopper renders the cement of a fluid nature and enables it to flow freely by gravity into the bags.

Staff Designs and Erects Plant

With minor exceptions the works have been planned throughout and the machinery and buildings erected by Messrs. G. & T. Earle's own staff.

Where Respiratory Disabilities Cause Lost Time

Highest Respiratory Disability Rate Among Workers Exposed to All Kinds of Weather—Exposure to Heavy Concentrations of Limestone Dust and Cement Dust, and Exposure to Sudden Changes in Temperature Also Cause Trouble—Other Departments Less Affected—Natural Susceptibility a Factor—Helping the Worker Find His Place

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THE frequency or incidence rate of disabling sickness for any group of persons is affected by a variety of factors, the more important of which have to be measured and evaluated before exact conclusions are possible concerning the effect of occupation.

Factors of Different Importance

The age factor, which is so important in the sickness severity rate based on the duration of incapacitation, was found to be a relatively unimportant influence in determining the frequency of respiratory disability among employees of a cement company. The workers over 45 years of age were incapacitated by respiratory illness for two consecutive working days or longer at a rate only 11 per cent higher than that among the men under 25 years of age, while those in the middle age group (25 to 44) had respiratory disability less often to the extent of 9 per cent, than those at ages 15 to 24.

Native Americans and foreign-born Italians constituted nearly 80 per cent of the cement works' personnel (in terms of years of life under observation). Inasmuch as the respiratory incidence rate was virtually the same for each of these two race stocks, the factor of racial susceptibility to respiratory disease could be disregarded in the present study. The physical status of the individual as appraised by the examining physicians was found to be of more importance than age in the occurrence of respiratory disability. The group composed of persons who were absent once or oftener for two consecutive working days or longer on account of alcoholic indulgence experienced 19 per cent more respiratory disability than did other employees of the company.

But none of these factors affected the respiratory incidence rate as much as one which was reflected in the mere fact as to whether an employee quit or did not quit over a certain period of time. The rate among the men who left during the three years of the study exceeded by 68 per cent the respiratory rate among those who did not leave.

Factor of Selection Resulting From Reaction to Working Environment

This unexpected result might have been due, it was first thought, to a larger proportion of persons in poor physical status among those who quit. Therefore the years of life under observation were distributed according to the physical rating of the workers. But the general physical condition of the men appeared to be no different among those who quit than among those who stayed.

What, then, accounted for the wide difference in the respiratory sickness experience of these two groups of cement workers? The analysis was pursued in greater detail in the hope that it would throw light on this interesting question. The two groups of employees were first subdivided according to the duration of their employment in the portland cement industry, and the respiratory frequency rates were computed for these subgroups. The results are given in Table 1.

The respiratory rates by length of service among those who stayed are illuminating. In this group the frequency of respiratory disability was remarkably low among those in the industry less than two years and from two to four years. The rate was even lower among those who had spent from four to eight years in cement making, but after about the eighth year in the industry, respiratory disability occurred much oftener, mounting from a rate of 235 cases per year per 1,000 men who had had four to eight years' employment in the industry to a rate of 605 cases annually per 1,000 men with more than eight years' service.

Among those who left during the period of observation, the highest respiratory disability rates occurred in the groups with less than two years and with two to four years of service. After the fourth year respiratory disabilities tended to decrease in frequency among the men who quit, though the rate remained high until the data became too meager for further observation. Among employees of less than eight years' service the respiratory rate was about twice as high in the group which quit during the study as in the group which did not quit. Yet, as stated above, the general physical condition of the men in the two groups was rated practically the same by our own examining physicians. Could the difference be due to a greater susceptibility to respiratory disease in the one group than in the other—a difference which would not be revealed ordinarily in a general physical examination?

Abstracted from the *Journal of Industrial Hygiene*, issue of October, 1929. This is the second article on the results of a study of exposure to calcium dusts presented in greater detail in United States Public Health Bulletin No. 176, "The Health of Workers in Dusty Trades. I. Health of Workers in a Portland Cement Plant." The first paper appeared in the June, 1929, issue of the *Journal of Industrial Hygiene*.

TABLE 1

Respiratory Incidence Rates According to Length of Service in the Cement Industry Among Those Who Quit as Compared With Those Who Did Not Quit During the Period of the Study[1]

	Annual No. of Respiratory Cases Per 1.000 Men Among—		No. of Respiratory Cases Among—	
Length of Service in Cement Industry	Those Who Quit[2]	Those Who Did Not Quit[2]	Those Who Quit[2]	Those Who Did Not Quit[2]
All lengths	563	336	171	154
Less than 8 yrs.	571	276	148	104
8 yrs. or longer	455	605	15	49
Less than 2 yrs.	576	282	87	48
2 to 4 yrs.	583	303	35	33
4 to 8 yrs.	542	235	26	23
8 yrs. or longer	455	605	15	49
Unknown	----	----	8	1

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[1] Only those cases were included which caused absence for two consecutive working days or longer.

[2] During the period of the study.

Natural Susceptibility to Respiratory Diseases

An answer to this question was afforded by the data at hand. The men who experienced no respiratory sickness which caused inability to work for two consecutive days or longer while they were on the payroll of the company during the period of the study were left out of consideration, and the frequency of respiratory attacks was ascertained for those who were disabled for more than one day by this type of illness during the three years of the investigation. Among the men who had been in the industry less than eight years, the group which quit averaged 1.203 respiratory attacks annually per person, compared with only 0.591 respiratory attacks per person per year in the group which did not quit during the study. This difference in the number of respiratory attacks per person was found to account for the greater frequency of respiratory sickness in the group which quit.

The comparative absence of respiratory susceptibility among those who tended to remain in the industry is indicative of a process of self-selection of workers on the basis of physical suitability for the work and the working environment. Those who tended to stay on were, apparently, better adapted physically for the conditions of work than those who shifted to some other industry. The group which quit did not have a larger proportion of physical weaklings, but merely a relatively larger number of persons who were more susceptible to the specific respiratory diseases which the given working conditions might aggravate.

Men in Cement Industry More than 8 Years

It will be observed in Table 1 that the respiratory rates were more nearly of the same magnitude in the "quit" as in the "did not quit" group for those with eight or more years' service. This is quite in accordance with what would be expected, since persons who kept on working in cement dust for eight or more years would naturally constitute a selected group from the standpoint of dust tolerance. For this reason it appears that the effect of the dust is best measured by computing the respiratory rate for all men in the study who had been in the industry for eight years or longer in comparison with the respiratory rate of the non-quitters having less than eight years' service. The dividing line was placed at the eighth year because at or about this point the frequency of respiratory disability began to increase perceptibly among those who stayed in the industry. The men who had worked in cement dust for eight years or longer experienced more than twice as many disabling cases of respiratory illness per 1,000 persons as the group having less than eight years' service. Not only did a larger percentage of these seasoned workers have one or more than one respiratory disability the longer they stayed in the industry, but the persons who suffered such disabilities experienced more frequent attacks of them. That this tendency was not simply a reflection of the age of the individuals who had given the longer service was shown by the fact that the trend was practically the same for the men under 45 years of age as for those above this age.

Gradual Influence of Calcium Dust

It is difficult to escape the conclusion that exposure to large quantities of calcium dust, especially amounts ranging from 50 to 100 million particles per cubic foot of air, tends to predispose men to certain diseases of the respiratory system after seven or eight years of work in such an environment. The respiratory diseases which caused disability most frequently among persons of longer service in the industry were infections of the nasal mucosa and bronchi, and a predisposition to influenza or grip was indicated. Long-continued exposure to the calcium dusts appeared not to predispose to pneumonia or to pulmonary tuberculosis.

Process of Accommodation to Environment

A certain physical ability to become temporarily adjusted to environment is indicated by the decrease in the respiratory frequency rate from about the second to the sixth or seventh year of service, and particularly in the number of respiratory attacks per person experiencing respiratory disability. In the more permanent group of workers this decrease could not have been due to a weeding out of the susceptibles, since no one in this group left the industry during the period of observation.

Respiratory Disability According to Nature of Environment

Although cement dust permeated virtually all departments of the mill, there were other dusts and other factors in the working environment, the reaction to which in terms of disabling sickness could be observed with reference to the selective process described above.

In the initial stages of manufacturing the principal dust came from limestone, which was found to contain about 6.5 per cent of free silica in the form of quartz, as compared with 1 per cent in the finished product, cement. Other dusts to which, however, only a few persons were exposed, are gypsum and bituminous coal dusts. In the open quarry, work is usually carried on without regard to the state of the weather. In the kiln room very high temperatures are encountered. Employees of the mechanical department may be shifted from one part of the plant to another to carry on repair work under widely different conditions of heat, cold, dust or dampness. For the purpose of studying the reaction in terms of respiratory disability to each of these conditions, employees were classified according to the nature of the conditions under which they worked, even though the number of persons in several of the groups was very small.

Employees of the office, storeroom, laboratory, power and electrical departments, and yard workers other than laborers, were regarded as being exposed to comparatively little dust. The yard laborers were placed in a separate category on account of the nature of their work and because their occupation constituted the vestibule to the plant, the new employees usually being given a probationary period in this work. The sickness rate for such a group would, therefore, probably reflect the reaction to work that is of a rather heavy nature, as well as the poor physical condition frequently found among casual workers in the least skilled and therefore least remunerative jobs. For these reasons the yard laborers were not included in the group exposed to relatively little dust, although the dust concentration in the yard was comparatively light except on windy days.

Employees exposed to heavier dust concentrations were grouped as follows:

(1) Exposed principally to cement dust:
    All finishing and bag room workers.
    All employees of packing department.
(2) Exposed principally to limestone dust:
    All employees in crusher houses, stone house and raw mill.
(3) Exposed to gypsum dust:
    Gypsum shovelers and scale men (finishing department).
(4) Exposed to bituminous coal dust:
    All employees in coal house.

Other types of exposure in which comparatively little dust was involved were as follows:

(1) Sudden changes in nature of working conditions incident to emergency and general repair work:
    All employees of mechanical department.
(2) High temperatures:
    All kiln room workers except flue gas samplers.
(3) Outdoor work in all kinds of weather:
    All unsheltered employees of quarry.

TABLE 2

Frequency of Disability[1] From Respiratory Disease, According to Nature of Exposure in a Cement Manufacturing Establishment

Nature of Exposure	No. of respiratory cases[1]	Annual No. of respiratory cases per 1,000 men	Ratio to rate among those exposed to relatively little dust[2]	Annual No. of respiratory cases 1,000 men among—		Ratio of respiratory rate for those who quit to rate for those who did not quit
				Those who quit[3]	Those who did not quit[3]	
Comparatively little dust[4]	31	267	100	361	225	160
Heavier concentrations of dust	140	433	162	514	373	138
a. Cement dust	83	480	180	619	348	178
1. Finishing and bag depts.	52	500	187	638	386	165
2. Packing dept.	31	449	168	595	281	212
b. Limestone dust[5]	36	340	127	237	391	61
c. Gypsum dust[6]	11	500	187	500	500	100
d. Bituminous coal dust[7]	10	454	170	750	308	244
Quarry labor[8]	53	558	209	813	429	190
Yard labor[9]	47	439	164	633	191	331
Sudden changes (mechanical dept.)	38	427	160	682	343	199
Heat in kiln room[10]	16	485	162	500	471	106
All employees of cement company	325	426	160	563	336	168

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[1] Causing absence for two consecutive working days or longer.
[2] Rate among men exposed to relatively little dust equals 100.
[3] During the period of the study.
[4] Employees of the office, storeroom, laboratory, power and electrical departments and yard (except yard laborers).
[5] Employees of the crusher house, stone house and raw mill.
[6] Gypsum shovelers and scale men (finishing department).
[7] Coal house workers and flue gas samplers.
[8] Exclusive of quarry workers who are sheltered from the weather.
[9] Yard laborers only.
[10] All kiln room workers except flue gas samplers.

Table 2 shows that the respiratory rates of the employees in the dustier departments of the plant and of those exposed to the other working conditions mentioned were all considerably higher than the rate among the men working in comparatively little dust. The small number of persons, however, in at least three of the groups—i. e., those exposed to gypsum, bituminous coal dust, and the heat of the kilns—renders impossible any definite conclusions concerning the effect of these conditions on the health of those exposed to them. Considering the larger groups, one finds that the dustier working places, outdoor work in all kinds of weather, and exposure to sudden changes in working conditions were associated with much higher respiratory disability rates than were shown for the group relatively unexposed to any of these conditions.

The respiratory rates according to nature of the exposure indicated wide differences in the sickness experience of relatively unselected workers as compared with the seasoned or selected group. The differences were most easily seen by referring to the last column in Table 2.

Helping the Worker Find His Place

Omitting from consideration the smallest groups—i. e., those exposed to gypsum, bituminous coal dust, and kiln room heat—one finds that the greatest differences in the frequency of respiratory disability among those who quit as compared with those who stayed occurred in yard labor. packing, the mechanical department, and quarry labor. In general, in these departments the heavier work of a cement mill is performed; the results therefore probably represent the reaction to heavy work as well as to dustiness and the other conditions mentioned. In these four departments, especially, the need is manifested for selecting and placing workers with more regard to their susceptibility to the effects of dust or other conditions involved. The employee apparently attempts to find work and working conditions for which he is physically well adapted, but he does it by the wasteful trial and error method. The factory employment department might prevent needless labor turnover by developing physical examinations which would indicate the extent of tolerance to different kinds of exposure to which applicants for work might be subjected in the course of duty, and by placing them with regard to the information thus obtained concerning their physical idiosyncrasies. Such a procedure would aid the worker in what he attempts to do anyway in rather blind fashion, and it affords the hope of development into an effective means of preventing industrial morbidity.

Sickness Rates in Different Departments

Of particular interest are the sickness rates according to type of exposure of those who stayed in the industry, because such rates appear to reflect the effect of work and working conditions on the health of a favorably selected group. For example, few men in poor physical condition could carry on indefinitely in cement packing, although they might be able to work for a long time in the less arduous occupations of the coal house or kiln room. It appeared necessary, therefore, to ascertain what proportion of the population, in terms of the years of life under observation, in each type of working environment were in poor physical condition or were regarded as being so by the examining physician when he rated men in class 3 or 4. Among those who did not quit, the groups which showed the smallest proportion in poor physical condition were the men in the packing department and those in the quarry, only 8 per cent of the years of life in each of these departments falling in class 3 or 4. On the other hand, 42 per cent of those who did not quit in the kiln room and 36 per cent in the coal house were given low physical ratings. In order to eliminate the effect of these wide differences in physical status the respiratory incidence rates were recomputed in Table 3 to show what the rate for each group would be if the distribution according to physical condition of the staying workers were the same under each type of working environment as among all employees of the plant as a whole. With the rates thus

TABLE 3

Frequency of Disability From Respiratory Diseases (Adjusted for Physical Status) Among Those Who Did Not Quit During the Study, by Nature of Exposure in a Cement Plant

Nature of Exposure[1]	No. of yrs. of life under observation	No. of respiratory cases[2]	Per cent of total yrs. of life in physical ratings 3 and 4	Annual No. of respiratory cases per 1,000 men (adjusted for physical status)
Comparatively little dust	80	18	10	234
Heavier concentrations of dust	185	69	16	376
a. Cement dust	89	31	12	356
1. Finishing & bag depts.	57	22	14	390
2. Packing dept.	32	9	8	294
b. Limestone dust	69	27	17	386
c. Gypsum dust	14	7	18	512
d. Bituminous coal dust	13	4	36	304
Quarry labor	63	27	8	437
Yard labor	47	9	31	178
Sudden changes (mechanical dept.)	67	23	21	335
Heat in kiln room	17	8	42	446
All employees of cement company	459	154	17	302

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[1] Departments and occupations included in each group are shown in footnotes 4 to 10 of Table 2.

[2] Causing absence for two consecutive working days or longer.

adjusted, the effect on the respiratory system of each of these several different kinds of exposure in the plant is seen more clearly.

The largest number of disabilities from respiratory diseases according to the adjusted rates occurred among those exposed to gypsum dust and to the heat of the kilns; but, as was previously pointed out, these groups were not large enough to afford significant sickness rates. The adjusted respiratory rates for the larger groups shown in Table 3 indicated that the relative importance of the several different types of exposure was as follows:

(1) Exposure to all sorts of weather (work continued during storms, etc.).

(2) Exposure to heavy concentrations of limestone dust.

(3) Exposure to heavy concentrations of cement dust.

(4) Exposure to sudden changes in temperature and other working conditions.

The lowest adjusted respiratory rates among the "selected" workers were for the yard laborers and the group exposed to relatively little dust. The yard laborers generally work out of doors, but ordinarily do not keep at their jobs in the open during storms and the severest weather as do the quarry workers. The exceptionally low adjusted respiratory rate of 178 cases a year per 1,000 "selected" yard laborers indicates the healthfulness of fairly heavy work out of doors among persons well adapted physically for this type of labor. The next to the lowest adjusted respiratory rate (234 cases a year per 1,000 men) occurred among the group relatively unexposed to any untoward working condition—namely, employees of the office, storeroom, laboratory, power and electrical departments.

Summary

The more important factors affecting the frequency of disabling attacks of respiratory disease among employees of a cement company were measured and evaluated before conclusions were drawn concerning the effect of working conditions. None of the factors measured affected the respiratory incidence rate as much as one which was reflected in the contrast between the respiratory rate among those who quit and the rate among those who did not quit during the three years of the study. A rather detailed analysis revealed indications of a process of self-elimination from the industry of those who were more susceptible to respiratory illness and who were affected deleteriously by the dust.

The effect on the respiratory system of exposure to different kinds of working conditions was observed by means of respiratory disability rates adjusted for differences in the physical condition of persons employed in each type of environment among men who tended to remain in the industry. Persons obliged to continue work in the open during all kinds of weather showed the highest disability rate from respiratory illness, and were followed by the group exposed to the heavier concentrations of dust. Men exposed to limestone dust experienced slightly more respiratory disability than those working in cement dust. The respiratory rate also was high in the emergency and general repair crews which were often subjected to very sudden changes in temperature and in the nature of other working conditions.

Canadian Cement Output Helps Make New Mineral Production Record

Showing considerable gain in production value in 1929 over 1928, cement production helped to establish the new record in Canadian output of minerals for the past year.

The total mineral production value of $307,146,494 represented a gain of over $32,000,000, according to preliminary report figures issued by the Dominion Bureau of Statistics.

Some of the provinces in which cement showed gains and the amounts are as follows: Quebec, $8,000,000; Ontario, $1,000,000; Manitoba, $7,000,000.

Ideal Constructs Pipeline to Supply Gas to Oklahoma Plant

The Ideal Cement Company, Denver, Colorado, has begun work on a 10-mile pipeline that will carry gas from Ideal owned wells to the Oklahoma Portland Cement Company plant at Ada, Okla., a property of the Ideal.

The company now has developed 100,000,000 cu. ft. of gas a day. Sixteen million cubic feet of gas have been purchased daily at a cost of $500,000 a year. Construction of the pipeline, costing around $150,000, is expected to result in a considerable saving. It is planned later to extend the line to other plants of the company.

Alpha Quarterly

The Alpha Portland Cement Company paid its regular quarterly dividend of 75 cents a share on April 15th to stock of record March 25th.

Economical Portable Screw Conveyor for Handling Sacks

Successfully Employed in Sugar Industry—Conveying Element of Parallel Steel Tubes with Spiral Beads Welded on—Driven by Portable Electric Power Head

A PORTABLE power-driven screw conveyor, which has been employed for some time in the sugar industry of California and Hawaii to handle bags of sugar, should be well worth investigation regarding its practicability and economy in handling sacks of cement and similar material. The conveyor may, in fact, be used in conveying and elevating any materials that are handled in bags, bales, bundles, crates or boxes, whose weight does not exceed the carrying capacity of the mechanism.

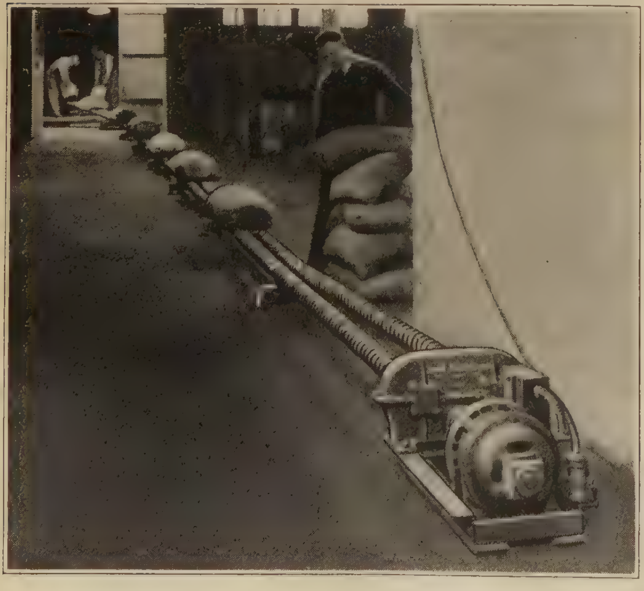
Tubular Screw Arrangement

This conveying equipment, made by the Clark Tructractor Company, consists essentially of two parallel tubular screws which are turned toward each other by a power head. The tubes are made of seamless cold drawn steel and the spiral beads are electrically welded to the tubes. The clear distance between the tubes may be adjusted to any distance between a minimum of 6 inches and a maximum of 12 inches, depending upon the size of the sacks or bags to be transported.

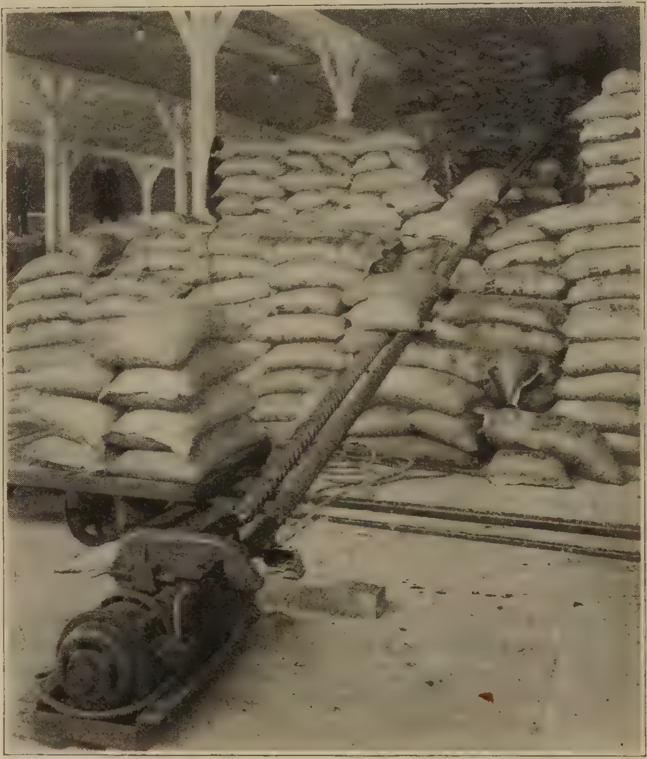
In a pair of tubes, the left-hand tube has a right-handed spiral and the right-hand tube has a left-handed spiral. In the actual operation the tubes are turned toward each other so that a sack moving along them is kept on the center because of this nudging action from both sides.

Capacity

Material may be carried forward at a speed of 90 feet per minute. Consequently, with sacks placed 5 feet apart, the capacity of the conveyor is about 1,200 sacks per hour. With small sacks of comparatively light weight the spacing of sacks might be reduced, bringing the capacity up to as much as 1,800 sacks per hour.



Conveying sacks from the warehouse to a freight car on the warehouse siding



The conveyor may be supported on piles of sacks already in place, and inclined upward as much as 30 degrees

A standard unit consists of six twin tubes or sections, each 8 feet and 4 inches in length, or a total length of 50 feet, attached to an electric power head. Power is transmitted from the power head through the twin tube sections by means of specially designed universals located at each sectional joint. An extension cord attached to the power head may be plugged into a power line wherever electric power is available.

Joints May Be Turned

The sections are connected to the power head and to each other with a universal joint having an automatic lock. Flexibility is obtained from the fact that any joint may be turned either vertically or horizontally to the amount of 15 degrees. As a result, material may be elevated on an incline of as much as 30 degrees, as well as transported horizontally.

The weight of the portable power head is about 250 pounds. Each of the twin tube sections weighs about 125 pounds, so that the total weight of a 50-foot unit is about 1,000 pounds. A unit may be quickly assembled or taken down, and transported in a trailer.

Applications

The illustrations show the use of this conveyor in a large sugar refinery in Hawaii. One picture shows how bags may be carried up on a 30-degree incline over existing piles of bags, the conveyor being supported at each sectional joint on sacks rearranged for the purpose. The other illustration shows bags of sugar being conveyed from the refinery's out-bound warehouse to a freight car on the warehouse siding. Both pictures furnish close views of the portable power head.

The possibilities of this portable conveyor are not confined to the handling of sacks of cement at certain points in a cement manufacturing plant. If the equipment is found to be economical it may be used with equal facility at branch cement warehouses, at retail material yards, and in fact at any point where sacks of cement are handled in a fairly continuous operation.

Ideal Cement Company Reports Excellent Business

In paying its regular quarterly dividend of 75 cents a share on April 1st, which amounted to $343,703, the Ideal Cement Company of Denver, Colorado, reported that all its plants with the exception of that at Utah are showing an increase over last year, and that sales for the first quarter of this year are fully 200,000 barrels over the corresponding period of last year.

Orders already in from Nebraska, Oklahoma, Kansas and Arkansas will keep its Arkansas plant operating to full capacity all year.

Associated Portland Manufacturers Show Profit for 1929

The Associated Portland Cement Manufacturers, Ltd., London, England, for the year ended December 31, 1929, reports a net profit after all charges, including depreciation of £367,514 against £366,379 in 1928.

A revenue of £935,000 is shown, which with the addition brought forward leaves available £1,075,000. Depreciation amounted to £267,000 and £141,000 was brought forward. A dividend of 8 per cent was declared.

International Earnings for Quarter Show Decrease

The report of the International Cement Corporation, New York City, shows a consolidated net income of $841,480 for the quarter ended March 31st, after all charges including federal taxes and contingencies for reserves, equal to $1.34 a share on 628,813 shares. This compares with $1,381,567, or $2.20 a share on 627,866 common shares in the preceding quarter and against $1,017,619 or $1.64 a share on 618,924 common shares in the first three months of 1929.

Lehigh Earnings

The Lehigh Portland Cement Company reports for the year ended on February 28th net earnings of $2,441,042 after provision for federal income tax and depreciation.

After deducting all preferred dividends paid there was available $961,473 for dividends on the issued common stock, equivalent to $2.13 a share.

Russian Government's Cement Requirements May Be Overestimated

The Russian governmental office "Stromstroj" was reorganized with the beginning of the new year. "Stromstroj" was until the end of 1929 the governmental department entrusted not only with the task of carrying out the reconstruction plans of the government, but also to provide the machinery for the plants. These latter tasks have now been turned over to other organizations, so that "Stromstroj" can devote all of its energies to reconstruction work of plant and factories.

The 1930 program includes the construction of 8 large cement mills. The new Podolski cement plant to be built near Moscow is to have a capacity of 1,000,000 barrels a year.

The demands for cement in Russia in 1930 will be about 1½ times greater than in the preceding year. That means that the Russian cement industry will have to produce 22,000,000 barrels. According to Mr. Skundin, a member of the Board of "Stromstroj," it will be difficult to keep the existing plants running for want of accessory materials and equipment, because the Russian steel plants are not able to meet the demand. For at least 7,000,000 barrels of cement there will not be any packing material. This cement cannot be shipped, and this again will make it impossible to maintain the construction program.

Exact dates have been fixed lately for the construction of the different cement plants, but these dates can only be kept up if building materials, equipment and machinery are delivered on time. The lack of foreign money is another and important reason for the difficulties arising ever and again for the Russian governmental offices, because machinery and equipment as well as salaries for specialists must be paid in foreign values. It is doubtful that the Russians will be able to overcome all these difficulties. If not, the "Stromstroj" will be unable to keep up to the construction program, and the requirements for portland cement will be far below the present estimate.—A. vK.

Oregon Cement Favored for Portland Municipal Jobs

Oregon cement is now being used exclusively on municipal jobs in the city of Portland. Specifications now require the bidders to state whether they are bidding on domestic or foreign cement and the city council can apply the 5 per cent differential allowed by the city charter in favor of home industry.

France Buying Cement From Jugoslavia

The French secretary of the navy has ordered 500 carloads of cement from the mills at Beltchin, Belgrade, for construction work in Algeria.

Cumberland Plant Reopens

The Cumberland Portland Cement Company plant at Cowan, Tenn., returned to operation April 1st, after having been idle since the first of the year.

Gas Line for Oklahoma Plant

The Oklahoma Portland Cement Co. is planning a 13-mile 12-in. natural gas line from Steedman to its plant at Ada, Okla.

Cement Statistics for March

Production Shows Increase of 12 Per Cent for March—Shipments Go Down—Totals for Year Lower

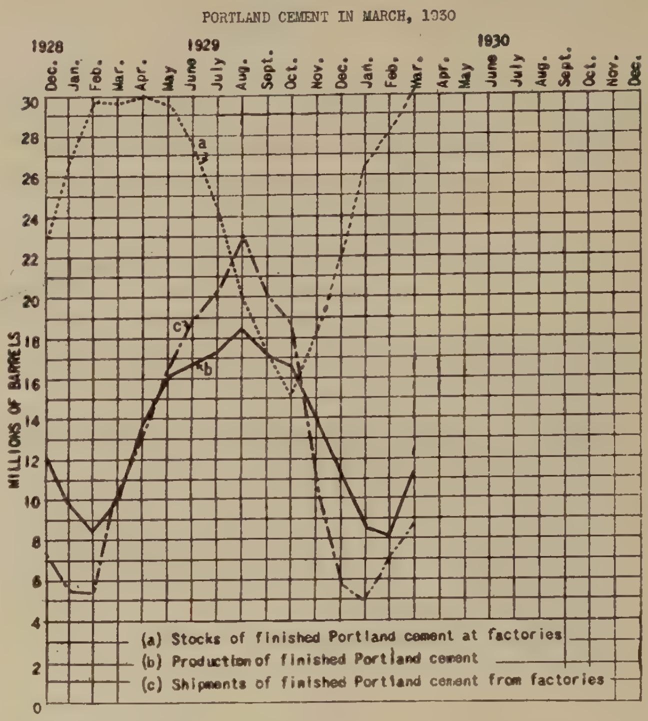
Relation of Production to Capacity

(Figures represent per cent)

	—March— 1929	—March— 1930	Feb. 1930	Jan. 1930	Dec. 1929
The month	47.4	**51.5**	41.5	38.8	51.5
The 12 months ended	**70.9**	66.1	65.6	65.5	66.4

	1929	1930	Increase or Decrease (—) Per Cent
Production, March	9,969,000	**11,225,000**	12.6
Shipments, March	**10,113,000**	8,846,000	—12.5
Stocks at end of March	29,724,000	**30,563,000**	2.8
Total production for year to date	**28,372,000**	27,885,000	—1.4
Total shipments for year to date	**21,268,000**	20,813,000	—2.1
No. of plants reporting	160	165	

NOTE: IN ORDER THAT THE READER MAY KNOW THE TREND AT A GLANCE, THE HIGHER FIGURE, WHETHER FOR EITHER YEAR, UNDER ANY CLASSIFICATION, APPEARS IN SLIGHTLY HEAVIER TYPE.


PORTLAND CEMENT IN MARCH, 1930

Production, Shipments, and Stocks of Finished Portland Cement, by Districts, in March, 1929, and 1930, and Stocks in February, 1930

District	Production—March 1929	Production—March 1930	Shipments—March 1929	Shipments—March 1930	Stocks at end of month 1929	Stocks at end of month 1930	Stocks at end of February, 1930*
Eastern Pa., N. J. and Md.	2,513,000	**2,717,000**	**2,506,000**	2,318,000	6,941,000	**7,028,000**	6,629,000
New York	593,000	**618,000**	**504,000**	484,000	**2,073,000**	1,687,000	1,552,000
Ohio, Western Pa. and W. Va.	908,000	**1,205,000**	**869,000**	724,000	3,650,000	**3,882,000**	3,401,000
Michigan	**476,000**	383,000	**543,000**	411,000	2,591,000	**2,734,000**	2,761,000
Wis., Ill., Ind. and Ky.	1,086,000	**1,129,000**	**948,000**	696,000	4,049,000	**4,578,000**	4,145,000
Va., Tenn., Ala., Ga., Fla. and La.	1,028,000	**1,099,000**	960,000	**969,000**	**2,248,000**	1,728,000	1,598,000
Eastern Mo., Ia., Minn. and S. Dak.	644,000	**971,000**	**700,000**	503,000	**4,297,000**	3,863,000	3,395,000
W. Mo., Neb., Kans., Okla. and Ark.	620,000	**945,000**	**905,000**	839,000	1,497,000	**1,940,000**	1,834,000
Texas	527,000	**694,000**	594,000	**627,000**	446,000	**845,000**	778,000
Colo., Mont., Utah, Wyo. and Idaho	57,000	**240,000**	144,000	**163,000**	451,000	**517,000**	441,000
California	**1,170,000**	873,000	**1,148,000**	816,000	894,000	**1,187,000**	1,131,000
Oregon and Washington	347,000	**351,000**	292,000	**296,000**	**587,000**	574,000	519,000
	9,969,000	**11,225,000**	**10,113,000**	8,846,000	29,724,000	**30,563,000**	28,184,000

Production, Shipments, and Stocks of Finished Portland Cement, by Months, in 1929 and 1930

Month	1929—Production	Production—1930	1929—Shipments	Shipments—1930	Stocks at end of month 1929	Stocks at end of month 1930
January	**9,881,000**	8,498,000	**5,707,000**	4,955,000	26,797,000	**27,081,000**
February	**8,522,000**	8,162,000	5,448,000	**7,012,000**	**29,870,000**	*28,184,000
March	9,969,000	**11,225,000**	**10,113,000**	8,846,000	29,724,000	**30,563,000**
April	13,750,000	....	13,325,000	....	30,151,000	....
May	16,151,000	....	16,706,000	....	29,624,000	....
June	16,803,000	....	18,949,000	....	27,505,000	....
July	17,315,000	....	20,319,000	....	24,525,000	....
August	18,585,000	....	23,052,000	....	20,056,000	....
September	17,223,000	....	19,950,000	....	17,325,000	....
October	16,731,000	....	18,695,000	....	15,381,000	....
November	14,053,000	....	11,222,000	....	18,213,000	....
December	11,215,000	....	5,951,000	....	23,550,000	....
	170,198,000	....	169,437,000	....	....	....

*Revised.

MEN and MILLS

Notes from the Field

Universal Atlas Makes New Executive Appointments

Additional appointments in the offices of the secretary and the treasurer of the Universal Atlas Cement Company were made in March.

Richard B. Hynes, formerly assistant secretary and assistant treasurer of the Atlas Portland Cement Company, has been appointed secretary of the company. Mr. Hynes was in the secretary's department of the former Atlas organization since 1916. Since 1925 he was assistant secretary and assistant treasurer of both the Atlas Portland Cement Company and of its subsidiary, the Atlas Gypsum Corporation. Mr. Hynes will be located at the Universal Atlas headquarters in Chicago.

T. E. O'Connor of New York is appointed treasurer, with headquarters in Chicago.

A. J. Joyce, formerly assistant credit manager of the Universal company and now appointed assistant treasurer at Chicago for the Universal Atlas Company, has had twenty-three years' experience in this field. He was connected with Universal for fourteen years and with the Illinois Steel Company and the Illinois Steel Warehouse Company, for seven and two years respectively.

E. M. Johnson, for twelve years eastern credit manager of the former Universal company and now named assistant treasurer at Pittsburgh of the new company, was connected with the former Universal company for twenty-three years.

J. L. Medler, member of the former Atlas organization for twenty-eight years and its assistant treasurer since 1911, is named assistant treasurer at New York of the Universal Atlas Company. Prior to joining the former Atlas company in 1901, he was connected with the Central railroad of New Jersey.

W. H. Dutcher for nearly 24 years purchasing agent for the former Atlas Portland Cement Company, has been appointed purchasing agent for the Universal Atlas Cement Company. Mr. Dutcher will have his office at the company's headquarters in Chicago.

O. H. D. Rohwer, heretofore division sales manager of the Universal Atlas Company, is appointed an assistant general sales manager. A. C. Cronkrite, who has been assistant general sales manager, continues in that position.

N. A. Kelly, previously sales manager at New York for the former Universal Portland Cement Company, is appointed to the same position with the enlarged organization.

A. O. Stark has been made assistant sales manager at New York and Wm. A. McIntyre, director of sales, working out of Philadelphia.

Aetna Superintendent Dies After Automobile Accident

Earl M. Bunce, superintendent of the Aetna Portland Cement Company plant at Fenton, Michigan, passed away at Flint, Michigan, on April 7th following an automobile accident.

Mr. Bunce had been in Detroit in conference with officials of the company and had left them late in the evening. The accident which caused his death occurred probably shortly after midnight, but he was not found until early morning.

Mr. Bunce had been superintendent for Aetna for about a quarter century.

Penn-Dixie Community Paves Its Streets

An eighteen-foot concrete road is being laid the entire length of Main Street in Richard City, Tenn., the Penn-Dixie Cement Company community.

The pavement will extend from the plant to the junction with the Lee highway. Other streets will be subsequently improved.

McKelvy, Former Alpha Superintendent, Dies

Wm. H. McKelvy, a former mill superintendent for the Alpha Portland Cement Company, died on March 30th at the age of 48.

Born in Pittsburgh, a son of Wm. M. McKelvy, former president of the company, Mr. McKelvy joined its sales force after leaving Princeton University about thirty years ago.

Pickford Succeeds Newberry on Medusa Board

Frederick Pickford succeeded Wm. B. Newberry, resigned, on the board of directors of the Medusa Portland Cement Company at the annual meeting on April 2nd, held at Cleveland, Ohio.

Robert Boyd Hill, National Portland Executive, Killed

Robert Boyd Hill, of San Antonio and Dallas, Texas, and an official of the National Portland Cement Company, died after being injured in an automobile accident near Harlingen, Texas, on March 28th.

W. M. Martin, a National company salesman, was also injured but recovered.

Carolina Portland Makes Appointments

P. G. Hanahan, vice-president, and general manager of the Carolina Portland Cement Company, New Bern, N. C., announces the appointment of Robert P. Martin as manager of the company's Jacksonville, Fla., branch.

Mr. Martin is a veteran in the building and construction business and for the last eleven years was connected with a lumber company.

Announcement is also made that W. A. Kline, for a number of years connected with the local branch of the Carolina company, has rejoined the company and will act as assistant branch manager. Mr. Kline has been with the company for more than ten years.

Harry C. Shields Joins Marquette Company

Harry C. Shields on April 1st joined the service department of the Marquette Cement Manufacturing Company, with headquarters at that company's general office at Chicago. He will be engaged in technical promotional work, giving particular attention to the manufacture of concrete products.

Mr. Shields came to this new connection from Julius Sorenson & Sons, Racine, Wis., manufacturers of concrete building units, where for several years he was in charge of sales and promotional work. Prior to that time he was with the Lehigh Portland Cement Company.

Nugent Returns to Michigan for Southwestern

W. S. Nugent, representative for the Southwestern Portland Cement Company, is again covering Michigan territory after a year and a half's absence.

His headquarters are at Lansing.

Mill Equipment

Hyper Chain Developed for Heavy Positive Power Transmission

Link-Belt Company, Indianapolis, Indiana, announces the development of a new steel drive chain which will be known as Link-Belt Hyper chain, for heavy positive power transmission. The chain is made from alloy steel, heat treated, and uses a new type of pin and cotter. The pins, bushing and holes in side bars are accurately ground, it is said. The cotters are of a special type and are so designed as not to work loose when once inserted and swelled into the holes provided in the pins for their reception, according to the manufacturer.

The Hyper SS-40 chain is said to have an ultimate strength of 75,000 pounds, and the SS-124 chain an ultimate strength of 150,000 pounds.

Texas Cement Plant to Have Robot Railway

Railway cars without passengers and apparently running without human agency, will transfer cement rock from the excavating pit to the crusher on a railway haulage system soon to be built by the Trinity Portland Cement Company of Dallas, Texas. A novel system of remote control, devised by the General Electric Company, will govern the operations of the cars.

Cement rock is excavated at some distance from the crusher at this plant. The "riderless larry car" system, previously applied by the General Electric Company to another installation, was adapted for the purpose.

Two operators, located where they can view the loading and unloading of the cars and their movements, are enabled by this system to govern practically all the operations of the cars. The track on which the cars will run will be divided into a number of sections. Four motor-driven cars will ride over the track, each propelled by two 50-horsepower, squirrel-cage motors. Energy for driving the motors will be collected from the track and an extra rail system. Switches in front of the centrally located operator will control the delivery of energy to each section of track.

New Midwest Locomotive Gasoline-Engine Driven

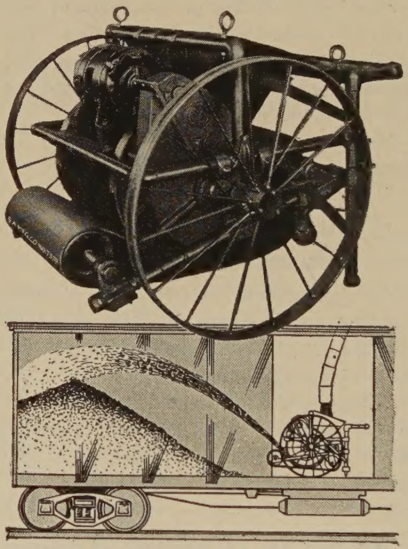
The Midwest Locomotive Works of Hamilton, Ohio, has recently put a new line of gasoline engine driven haulage locomotives into production.

The line, when completed, will include eleven individual ratings, namely 4, 5, 6, 7, 8, 9, 10, 12, 16, 20 and 25 ton respectively.

The main features of design and construction are uniform for the whole line, allowing, of course, for variations in the size and weights of the parts. They are of the single truck, outside frame type, the patented one piece frame being made of semi-steel casting.

New Box Car Loader Has 350 Tons Per Hour Capacity

Application of centrifugal force enables this new heavy duty box car loader to throw bulk material to the farthest corners of a box car. The machine is light enough to be handled by one man and has a capacity of 350 tons per hour—enough to fill four to seven cars per hour, it is said.



In operation, the machine is wheeled into the car to be loaded, the motor started, material fed into the hopper and the stream thrown from the loader is directed to fill one end of the car. No further attention is needed except to swing the machine around to fill the other end, the manufacturer states.

This new heavy duty loader is manufactured by Stephens-Adamson of Aurora, Ill., who have had a small loader on the market for several years. The present machine will handle material with lumps as large as 6 in., and the angle of discharge can be set to pile to any height up to 9 ft. above the floor.

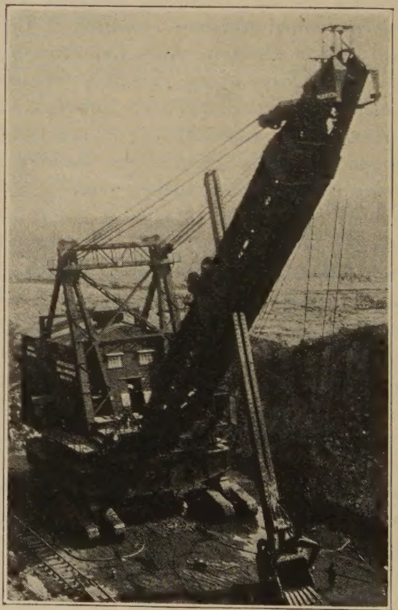
New E. C. & M. Master Switch for Cranes

A new master switch being built by the Electric Controller and Manufacturing Company, Cleveland, to regulate the control circuits of a magnetic contactor controller, is intended for use on cranes and hoists, and other applications where full speed control from the master switch is desired.

The almost frictionless operation of this, the Type NT master switch, is due to the use of ball bearings, the short throw of the operating handle, the absence of gears, and the fact that the contact fingers always ride on uninterrupted plane surface, the manufacturer states.

American Makes Largest All-Manganese Steel Dipper

The unit illustrated below is said to be the largest, all-manganese steel power shovel dipper ever made. This power shovel dipper was cast and assembled at the Chicago Heights plant of the American Manganese Steel Company for the United Electric Coal Company, Danville, Illinois.



The dipper is 14 ft. high over the bail, 12 ft. wide between outsides of bail brackets and 14 ft. from the ends of the dipper teeth to the bottom of the door; it weighs 37 tons (empty) and is of 15 cu. yds. capacity.

The entire plant is electrified with General Electric Company equipment so far as it is economically possible.

With the Manufacturers

Industrial Literature

Jones Issues New Reducer Catalog

Its Herringbone and Herringbone-Maag speed reducers are the subject of *Catalog No.* 45 issued by the *W. A. Jones Foundry and Machine Co.*, Chicago. Details of design and construction, horsepower ratings, dimensions, assembly diagrams, and installation views are included.

Stearns Catalog on Idlers

The Stearns Conveyor Company, Cleveland, a division of Chain Belt Company, Milwaukee, has recently completed a catalog and engineering data book containing complete and specialized information on the designs and application of Rex-Stearns Timken idlers for all types of belt conveyors, together with all allied and auxiliary equipment necessary for complete belt conveyor installations.

Safe Transportation of Explosives

The current issue of *"Explosives Progress"* tells of the excellent record made by the United States and Canadian railroads in the carrying of explosives for three consecutive years.

The Institute of Makers of Explosives, New York City, publishes "Explosives Progress."

Feeder Features

In a 4-page leaflet distributed by the *American Manganese Steel Company*, Chicago Heights, Illinois, eight features of Amsco feeders are listed. The leading item concerns manganese steel feeders and pan conveyors.

Link-Belt News

The *"Link-Belt News"* issued bi-monthly by the *Link-Belt Company*, Chicago, contains news and interesting facts about Link-Belt materials handling and power transmission chains and machinery.

Dust Problems

The 1930 edition of *"Dust Problems,"* presenting "an analysis of the problem in general and as applied to representative cases," is now available upon request to *Dust Recovery, Inc.*, New York City.

Nordberg Units

Literature published by the *Nordberg Manufacturing Co.*, Milwaukee, Wis., describes the Nordberg TracKrane—"a new, full-revolving crane with safety type hoist for rail laying or any job where a fast, light-weight crane can be used."

Another leaflet is devoted to the Nordberg patented track machine.

On Amsco Products

An especially interesting recent issue of *"The Amsco Bulletin"* is that for April, 1930, in which are found a number of items relating to a variety of Amsco products.

The bulletin is issued by the *American Manganese Steel Co.*, Chicago Heights, Ill.

To Solve Power Factor Problems

The General Electric Company announces a new system of solving power factor problems, described fully in a new publication, GET-191, entitled *"Solving Power Factor Problems by Scale."* This is a graphic method involving simple computations only.

Crane Speed

Faster crane operation is the theme of a new four-page folder prepared by the *Electric Controller and Mfg. Co.*, Cleveland, Ohio. The unit described is the Wright dynamic lowering circuit. Power requirements and power savings are charted. Specifications follow.

On Fire Brick

A new four-page folder issued by the *Laclede-Christy Clay Products Company*, St. Louis, Mo., is devoted to the Laclede fire brick and lists numerous users of the product.

NOTES FROM THE FIELD

Gardner-Denver Changes

B. Van Dyke, of the Quincy, Ill., sales division of the *Gardner-Denver Co.*, has been transferred to the New York office of the organization. *Hendrick Stolk*, until recently with Stoksvis & Zonen, of Holland, has just been transferred to St. Louis from the Quincy plant.

Ian Duncan, formerly of Glasgow, Scotland, was to sail the week of March 31 for Santiago, Chili, where he will represent the company in the mining districts of that country. His headquarters will be with Spencer & Waters, Ltd., Chilean agents for Gardner-Denver.

Link-Belt Representatives

Link-Belt Company, Chicago, Illinois, announce the appointment of the following agents who will handle their complete line of crawler cranes, shovels, draglines, and locomotive cranes:

P. L. Tippett, Rhodes Building, Atlanta, Georgia; Jos. C. Fiorello Co., Larkin Terminal Bldg., Buffalo, New York; Bacon-Hibbard-Eichman, Inc., 917 Central Avenue, Cleveland, Ohio.

Daniels Amsco Vice-President

The American Manganese Steel Company, Chicago Heights, Ill., announces the election of *A. W. Daniels* as vice-president in charge of sales, effective March 26.

After traveling extensively as a commercial representative, in 1920 Mr. Daniels became the Amsco Chicago office manager. Two years later he was promoted to central sales manager, which position he occupied but one year before his appointment in 1923 as general sales manager of the American Manganese Steel Company.

MacDonald Engineer and Office Removal

M. E. Crosby has become associated with the *MacDonald Engineering Company*, Chicago, as chief engineer, a recent announcement states.

The company states also that the removal of its Chicago office to the One LaSalle Street Building is effective May 1st.

Serves Powder Industry Fifty Years

Celebrating his fiftieth year of service to the explosives industry, *C. D. Prickett*, vice-president and director of the *Hercules Powder Company*, was the guest of Russell H. Dunham, president of the company, at a dinner on April 1st, attended by the members of the Hercules board of directors.

Chain Belt New York Office Moves

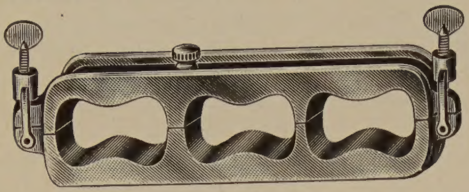
Chain Belt Company of Milwaukee has moved its New York office into larger quarters in the new Chrysler Building, 405 Lexington Ave., New York City.

W. H. Quinn is New York district manager.

E-M Chicago Office in New Location

Electric Machinery Manufacturing Company announces that their Chicago office is now located in Room 1567, 20 North Wacker Drive Building.

Laboratory Apparatus for Cement Testing



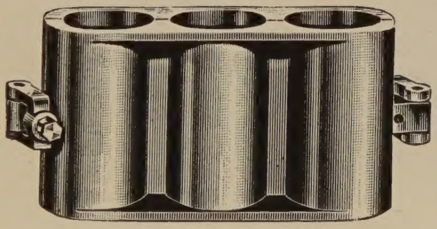
2406

Laboratory Tests for tensile strength and compressive strength of Portland Cement should be performed according to Standard A. S. T. M. Specifications. A very necessary requisite for these tests are molds according to A. S. T. M. design.

2404 BRIQUETTE MOLD—Single, of brass with end clamps for forming test pieces for tension tests. According to the dimensions specified in A. S. T. M. Test C 9-26 .... 4.20

2406 BRIQUETTE GANG MOLDS—A. S. T. M., of brass with end clamps.

No. of briquettes	2	3	4	5	6
Each	7.00	10.50	14.00	17.50	21.00



2423

2422 CYLINDRICAL MOLD—Brass, for preparing cylinders used in determining the compressive strength of Portland Cement Mortars. Diameter, 2 inches; height, 4 inches. According to the dimensions specified in A. S. T. M. Tentative Test C9-16T 3.25

2423 CYLINDRICAL MOLD—Triple, for preparing three cylindrical test pieces at one time. Diameter of each cylinder, 2 inches; height 4 inches 16.00

These molds are carried in stock for immediate delivery

For a complete listing of Cement Testing Apparatus and Chemical Laboratory Apparatus refer to Catalog C. Write for a copy if you do not have one.

THE CHEMICAL RUBBER CO.
Laboratory Apparatus and Chemicals
West 112th Street and Locust Avenue
Cleveland, Ohio

Solving the Contractor-Dealer Discount Problem

The following editorial in the March issue of The Constructor, published by the Associated General Contractors of America, is of particular interest because of its bearing on the dealer discount problem. The editorial follows:

"Within the last few months there has occurred a decided change in attitude of organized contractors, material men and manufacturers with regard to questions that concern merchandising policies, terms and relationships. In October, 1929, in these pages we pointed out the need for these groups to get together with a view to analyzing and determining upon the relative positions of each group in the merchandising structure of the industry.

"Remarkable progress has since been made in just this manner. Meetings and communications have cleared the atmosphere and removed existing obstacles to a joint meeting between representatives of the National Builders' Supply Association, the Associated General Contractors and individual cement manufacturers to discuss these matters and definitely promote orderly merchandising policies. All groups now see the value of such procedure. Definite and constructive progress in the future appears therefore to be assured.

"An instance of what may be accomplished by cooperation has been provided by the joint action of organized contractors and material men in Nebraska. The Nebraska Chapter of the Associated General Contractors and the Nebraska Lumber Merchants' Association appointed a joint committee as a result of a general meeting held December 5, 1929, on the subject of terms, discounts and commissions.

"In January this joint commitee of dealers and contractors discussed the subject from all angles with regard to the services rendered by dealers and the schedules of compensation which dealers should receive for specific services. As a result of five hours of discussion at one meeting a definite schedule was drawn up to cover the major conditions that exist in the sale of cement to highway contractors and to other classes of engineering contractors. They established what was conceded to be a fair and workable agreement, gave recognition to both the contractor and the dealer and established the basis for transactions between the two groups.

"All of the schedules and stipulations were based on more than single carload purchases. Agreement was reached as to what constituted the various kinds of service which dealers were called upon to render and as to the compensation which both dealers and quantity buyers would receive under each service combination.

"The contractors and dealers of Nebraska are to be complimented for the pioneering work that they have done in bringing the questions concerning merchandising procedure out into the open.

"The viewpoint that the contractor should have no voice in the merchandising procedure set up by agreement between manufacturer and dealer as well as the viewpoint that the dealer serves no function in the sale of a material shipped direct by manufacturer to contractor, both require modification. So does the viewpoint that the merchandising plan of a manufacturer is outside the province of both the dealer and the contractor. All three groups are vitally concerned and it is becoming increasingly evident that the way toward the development of a sound merchandising structure is through joint discussions, joint action and joint observance of the rights of all three groups, with a constant view toward the benefit of the industry as a whole."